

千田益生、 内尾祐司、 芥藤知行		内尾 祐 司、「ここ が聞きたい! 名医にQ」 番組制作 班、主婦と 生活社ライ フ・プラス 編集部	NHKここが聞 きたい! 名医 にQ ひざ痛の ベストアンサ ー【ポケット 版】	主婦と生 活社	東京	2013	
------------------------	--	--	---	------------	----	------	--

雑誌

発表者氏名	論文タイトル名	発表誌名	巻号	ページ	出版年
<u>Akune T</u> , Muraki S, Oka H, Tanaka S, Kawaguchi H, <u>Tokimura F</u> , Yoshida H, <u>Suzuki T</u> , <u>Nakamura K</u> , <u>Yoshimura N</u>	Incidence of certified need of care in the long-term care insurance system and its risk factors in the elderly of Japanese population-based cohorts: The ROAD study.	Geriatr Gerontol Int			in press
<u>Akune T</u> , Muraki S, Oka H, Tanaka S, Kawaguchi H, <u>Tokimura F</u> , Yoshida H, <u>Suzuki T</u> , <u>Nakamura K</u> , <u>Yoshimura N</u>	Association of physical activities of daily living with the incidence of certified need of care in the long-term care insurance system of Japan: the ROAD study.				in press
<u>Yoshimura N</u> , <u>Akune T</u> , <u>Fujiwara S</u> , Shimizu Y, Yoshida H, <u>Nishiwaki Y</u> , Sudo A, Omori G, Yoshida M, Shimokata H, <u>Suzuki T</u> , Muraki S, Oka H, <u>Nakamura K</u>	Incidence of disability and its associated factors in Japanese men and women: The Longitudinal Cohorts of Motor System Organ (LOCOMO) study.	J Bone Miner Metab			in press
<u>Yoshimura N</u> , <u>Akune T</u> , <u>Fujiwara S</u> , Shimizu Y, Yoshida H, Omori G, Sudo A, <u>Nishiwaki Y</u> , Yoshida M, Shimokata H, <u>Suzuki T</u> , Muraki S, Oka H, <u>Nakamura K</u>	Prevalence of knee pain, lumbar pain and its co- existence in Japanese men and women: The LOCOMO (Longitudinal Cohorts of Motor System Organ) study.	J Bone Miner Metab			in press
Muraki S, <u>Yoshimura N</u> , <u>Akune T</u> , Tanaka S, Takahashi I, <u>Fujiwara S</u>	Prevalence, incidence, and progression of lumbar spondylosis by gender and age strata.	Mod Rheumatol			in press

Muraki S, <u>Akune T</u> , Nagata K, Ishimoto Y, Yoshida M, <u>Tokimura E</u> , Tanaka S, Oka H, Kawaguchi H, <u>Nakamura K</u> , <u>Yoshimura N</u>	Association of knee osteoarthritis with onset and resolution of pain and physical functional disability: The ROAD study.	Mod Rheumatol			in press
Kagotani R, Yoshida M, Muraki S, Oka H, Hashizume H, Yamada H, Enyo Y, Nagata K, Ishimoto Y, Teraguchi M, Tanaka S, <u>Nakamura K</u> , Kawaguchi H, <u>Akune T</u> , <u>Yoshimura N</u>	Prevalence of diffuse idiopathic skeletal hyperostosis (DISH) of the whole spine and its association with lumbar spondylosis and knee osteoarthritis: the ROAD study.	J Bone Miner Metab			in press
<u>Akune T</u> , Muraki S, Oka H, Tanaka S, Kawaguchi H, <u>Nakamura K</u> , <u>Yoshimura N</u>	Exercise habits during middle age are associated with lower prevalence of sarcopenia: the ROAD study.	Osteoporos Int	25	1081-1088	2014
Teraguchi M, <u>Yoshimura N</u> , Hashizume H, Muraki S, Yamada H, Minamide A, Oka H, Ishimoto Y, Nagata K, Kagotani R, Takiguchi N, <u>Akune T</u> , Kawaguchi H, <u>Nakamura K</u> , Yoshida M	Prevalence and distribution of intervertebral disc degeneration over the entire spine in a population-based cohort: the Wakayama Spine Study.	Osteoarthritis Cartilage	22	104-110	2014
Muraki S, Oka H, <u>Akune T</u> , En-yo Y, Yoshida M, Sasaki S, <u>Nakamura K</u> , Kawaguchi H, <u>Yoshimura N</u>	Association of dietary intake with joint space narrowing and osteophytosis at the knee in Japanese men and women: The ROAD Study.	Mod Rheumatol	24	236-242	2014
<u>Yoshimura N</u> , Nagata K, Muraki S, Oka H, Yoshida M, Enyo Y, Kagotani R, Hashizume H, Yamada H, Ishimoto Y, Teraguchi M, Tanaka S, Kawaguchi H, Toyama Y, <u>Nakamura K</u> , <u>Akune T</u>	Prevalence and progression of radiographic ossification of the posterior longitudinal ligament and associated factors in the Japanese population: a 3-year follow-up of the ROAD study.	Osteoporos Int	25	1089-1098	2014

Muraki S, <u>Akune T</u> , Ishimoto Y, Nagata K, Yoshida M, Tanaka S, Oka H, Kawaguchi H, <u>Nakamura K</u> , <u>Yoshimura N</u>	Risk factors for falls in a longitudinal population-based cohort study of Japanese men and women: The ROAD Study.	Bone	52	516-523	2013
Muraki S, Oka H, <u>Akune T</u> , Ishimoto Y, Nagata K, Yoshida M, <u>Tokimura F</u> , <u>Nakamura K</u> , Kawaguchi H, <u>Yoshimura N</u>	Physical performance, bone and joint diseases, and incidence of falls in Japanese men and women: A longitudinal cohort study.	Osteoporos Int	24	459-466	2013
Ishimoto Y, <u>Yoshimura N</u> , Muraki S, Yamada H, Nagata K, Hashizume H, Takiguchi N, Minamide A, Oka H, Kawaguchi H, <u>Nakamura K</u> , <u>Akune T</u> , Yoshida M	Associations between radiographic lumbar spinal stenosis and clinical symptoms in the general population: The Wakayama Spine Study.	Osteoarthritis Cartilage	21	738-788	2013
Oka H, <u>Akune T</u> , Muraki S, Tanaka S, Kawaguchi H, <u>Nakamura K</u> , <u>Yoshimura N</u>	The mid-term efficacy of intra-articular hyaluronic acid injections on joint structure: a nested case control study.	Mod Rheumatol	23	722-728	2013
<u>Yoshimura N</u> , Muraki S, Oka H, Morita M, Yamada H, Tanaka S, Kawaguchi H, <u>Nakamura K</u> , <u>Akune T</u>	Profiles of vitamin D insufficiency and deficiency in Japanese men and women: association with biological, environmental, and nutritional factors and coexisting disorders: the ROAD study.	Osteoporos Int,	24	2775-2787	2013
Kojima N1, Kim H, Saito K, Yoshida H, Yoshida Y, Hirano H, <u>Obuchi S</u> , Shimada H, <u>Suzuki T</u>	Association of knee-extension strength with instrumental activities of daily living in community-dwelling older adults.	Geriatr Gerontol Int.			in press
<u>Suzuki T</u> , Shimada H, Makizako H, Doi T, Yoshida D, Ito K, Shimokata H, Washimi Y, Endo H, Kato T	A randomized controlled trial of multicomponent exercise in older adults with mild cognitive impairment.	PLOS ONE	8	e61483	2013

Shimada H, <u>Suzuki T</u> , Suzukawa M, Makizako H, Doi T, Yoshida D, Tsutsumimoto K, Anan Y, Uemura K, Ito T, Lee S, Park H	Performance-based assessments and demand for personal care in older Japanese people: a cross-sectional study.	BMJ OPEN	3	e002424	2013
Kim H, <u>Suzuki T</u> , Saito K, Yoshida H, Kojima N, Kim M, Sudo M, Yamashiro Y, Tokimitsu I	Effects of exercise and tea catechins on muscle mass, strength and walking ability in community-dwelling elderly Japanese sarcopenic women: A randomized controlled trial.	Geriatr Gerontol Int	13	458-465	2013
Uemura K, Shimada H, Makizako H, Doi T, Yoshida D, Tsutsumimoto K, Anan Y, <u>Suzuki T</u>	Cognitive function affects trainability for physical performance in exercise intervention among older adults with mild cognitive impairment.	Clinical Interventions in Aging	8	97-102	2013
Fujita H, <u>Suzuki T</u> , Shoda S, Kawakubo Y, Ohno K, Giannakopoulou P, Harihara S	Contribution of antemortem tooth loss (AMTL) and dental attrition to oral palaeopathology in the human skeletal series from the Yeon-ri site, Souty Korea.	International Journal of Archaeology	1	1-5	2013
Makizako H, Shimada H, Doi T, Park H, Yoshida D, Uemura K, Tsutsumimoto K, Liu-Ambrose T, <u>Suzuki T</u>	Poor balance and lower gray matter volume predict falls in older adults with mild cognitive impairment	BMC Neurology	13	102	2013
Makizako H, Shimada H, Doi T, Park H, Yoshida D, <u>Suzuki T</u>	Six-Minute Walking Distance Correlated with Memory and Brain Volume in Older Adults with Mild Cognitive Impairment: A Voxel-Based Morphometry Study.	Dement Geriatr Cogn Disord Extra	3	223-232	2013
Shimada H, Makizako H, Doi T, Yoshida D, Tsutsumimoto K, Anan Y, Uemura K, Ito T, Lee S, Park H, <u>Suzuki T</u>	Combined Prevalence of Frailty and Mild Cognitive Impairment in a Population of Elderly Japanese People.	JAMDA	14	518-524	2013

Yoshimatsu T, Yoshida D, Shimada H, Komatsu T, Harada A, <u>Suzuki T</u>	Relation between near-infrared spectroscopy and subcutaneous fat and muscle thickness measured by ultrasonography in Japanese community-dwelling elderly.	Geriatr Gerontol Int	13	351-357	2013
Uemura K, Shimada H, Makizako H, Yoshida D, Doi T, Yamada M, <u>Suzuki T</u>	Factors associated with life-space in older adults with amnesic mild cognitive impairment.	Geriatr Gerontol Int	13	161-166	2013
Doi T, Shimada H, Makizako H, Yoshida D, Shimokata H, Ito K, Washimi Y, Endo H, <u>Suzuki T</u>	Characteristics of cognitive function in early and late stages of amnesic mild cognitive impairment.	Geriatr Gerontol Int,	13	83-89	2013
Makizako H, Doi T, Shimada H, Park H, Uemura K, Yoshida D, Tsutsumimoto K, Anan Y, <u>Suzuki T</u>	Relationship between going outdoors daily and activation of the prefrontal cortex during verbal fluency tasks (VFTs) among older adults: a near-infrared spectroscopy study.	Arch Gerontol Geriatr	56	118-123	2013
Doi T, Makizako H, Shimada H, Yoshida D, Tsutsumimoto K, Sawa R, Misu S, <u>Suzuki T</u>	Effects of multicomponent exercise on spatial-temporal gait parameters among the elderly with amnesic mild cognitive impairment (aMCI): Preliminary results from a randomized controlled trial (RCT).	Arch Gerontol Geriatr	56	104-108	2013
Shibasaki K, <u>Ogawa S</u> , Yamada S, Iijima K, Eto M, Kozaki K, Toba K, Akishita M, Ouchi Y	Association of decreased sympathetic nervous activity with mortality of older adults in long-term care.	Geriatr Gerontol Int	14	159-166	2014
Ota H, Akishita M, Tani H, Tatefuji T, <u>Ogawa S</u> , Iijima K, Eto M, Shirasawa T, Ouchi Y	trans-Resveratrol in Gnetum gnemon protects against oxidative-stress-induced endothelial senescence.	J Nat Prod	76	1242-1247	2013
Gotanda H, Kameyama Y, Yamaguchi Y, Ishii M, Hanaoka Y, Yamamoto H, <u>Ogawa S</u> , Iijima K, Akishita M, Ouchi Y	Acute exogenous lipid pneumonia caused by accidental kerosene ingestion in an elderly patient with dementia: a case report.	Geriatr Gerontol Int	13	222-225	2013

Son BK, Akishita M, Iijima K, <u>Ogawa S</u> , Arai T, Ishii H, Maemura K, Aburatani H, Eto M, Ouchi Y	Thrombomodulin, a novel molecule regulating inorganic phosphate-induced vascular smooth muscle cell calcification.	J Mol Cell Cardiol	56	72-80	2013
Tatsukawa Y, Misumi M, Yamada M, Masunari N, Oyama H, Nakanishi S, Fukunaga M, <u>Fujiwara S</u>	Alteration of body mass index and body composition in atomic bomb survivors.	Int J Obes	37	1123-1128	2013
Nishizawa Y, Ogata H, Miura M, Inaba M, Ichimaru, Shiraki M, Takada J, Chaki H, <u>Hagino H</u> , <u>Fujiwara S</u> , Fukunaga M, Miki T, <u>Yoshimura N</u>	Guideline for the use of bone metabolic markers in the diagnosis and treatment of osteoporosis (2012 edition).	J Bone Miner Metab	31	1-15	2013
Johansson H1, Kanis JA, Odén A, McCloskey E, Chapurlat RD, Christiansen C, Cummings SR, Diez-Perez A, Eisman JA, <u>Fujiwara S</u> , Glüer CC, Goltzman D, Hans D, Khaw KT, Krieg MA, Kröger H, LaCroix AZ, Lau E, Leslie WD, Mellström D, Melton LJ 3rd, O'Neill TW, Pasco JA, Prior JC, Reid DM, Rivadeneira F, van Staa T, <u>Yoshimura N</u> , Zillikens MC	A meta-analysis of the association of fracture risk and body mass index in women.	J Bone Miner Res	29	223-233	2013
Soen S, Fukunaga M, Sugimoto T, Sone T, <u>Fujiwara S</u> , Endo N, Gorai I, Shiraki M, <u>Hagino H</u> , Hosoi T, Ohta H, Yoneda T, Tomomitsu T	Diagnostic criteria for primary osteoporosis: year 2012 revision.	J Bone Miner Metabo	31	247-257	2013

宗圓聰、福永仁夫、杉本利嗣、曾根照喜、 <u>藤原佐枝子</u> 、遠藤直人、五來逸雄、白木正孝、萩野浩、細井孝之、太田博明、米田俊之、友光達志	原発性骨粗鬆症の診断基準（2012年度改訂版）	Osteoporosis Jpn	21	9-21	2013
森諭史、宗圓聰、萩野浩、中野哲雄、伊東昌子、 <u>藤原佐枝子</u> 、加藤義治、徳橋泰明、戸川大輔、遠藤直人、澤口毅	椎体骨折評価基準（2012年度改訂版）	Osteoporosis Jpn	21	25-32	2013
高橋郁乃、増成直美、 <u>藤原佐枝子</u>	高齢者の動脈硬化性疾患と骨折リスク 広島コホート調査	Osteoporosis Jpn	21	90-93	2013
<u>藤原佐枝子</u>	骨粗鬆症の概念・定義・疫学	Hormone Frontier in Gynecology	20	201-204	2013
<u>藤原佐枝子</u>	FRAXに含まれる骨折危険因子	内科	111	657-660	2013
<u>藤原佐枝子</u>	骨粗鬆症による骨折の疫学	日本臨牀	71,増刊2	433-438	2013
<u>藤原佐枝子</u>	骨折の危険因子 図で見る骨粗鬆症2013	Osteoporosis Jpn 別冊	21	46-47	2013
<u>藤原佐枝子</u>	骨折リスクとその評価 FRAXの活用	Geriat Med	51	1037-1040	2013
<u>大淵修一</u>	虚弱高齢者の運動指導	体育の科学	63	372-378	2013
稲葉康子、 <u>大淵修二</u> 、新井武志、柴喜崇、岡浩一朗、渡辺修一郎、木村憲、長澤 弘	地域在住高齢者に対する運動介入が1年後の運動行動に与える影響 ランダム化比較試験	日本老年医学会雑誌	50	788-796	2013
<u>西脇祐司</u>	【知る 診る 防ぐ!ロコモティブシンドローム】 サルコペニア	関節外科	32	1125-1128	2013
<u>Hagino H</u> , Kishimoto H, Ohishi H, Horii S, Nakamura T	Efficacy, tolerability and safety of once-monthly administration of 75mg risedronate in Japanese patients with involuntional osteoporosis: a comparison with a 2.5mg once-daily dosage regimen.	Bone	59	44-52	2014
Kondo T, Kakuda W, Yamada N, Shimizu M, <u>Hagino H</u> , Abo M	Effect of low-frequency rTMS on motor neuron excitability after stroke.	Acta Neurol Scand	127	26-30	2013

Sakamoto K, Endo N, Harada A, Sakada T, Tsushita K, Kita K, <u>Hagino H</u> , Sakai A, Yamamoto N, Okamoto T, Liu M, Kokaze A, Suzuki H	Why not use your own body weight to prevent falls? A randomized, controlled trial of balance therapy to prevent falls and fractures for elderly people who can stand on one leg for ≤ 15 s.	J Orthop Sci	18	110-120	2013
Nagira K, <u>Hagino H</u> , Kameyama Y, Teshima R	Effects of minodronate on cortical bone response to mechanical loading in rats.	Bone	53	277-283	2013
Sugimoto T, Shiraki M, Nakano T, Kishimoto H, Ito M, Fukunaga M, <u>Hagino H</u> , Sone T, Kuroda T, Nakamura T	Vertebral fracture risk after once-weekly teriparatide injections: follow-up study of Teriparatide Once-Weekly Efficacy Research (TOWER) trial.	Curr Med Res Opin	29	195-203	2013
Dokai T, Nagashima H, Okano T, Nanjo Y, Kishimoto Y, Tandai A, Kakite S, <u>Hagino H</u>	Morphological and Volumetric Analysis of the Development of Vertical Subluxation in Rheumatoid Arthritis.	Yonago Acta Medica	56	21-27	2013
Tanida A, Kishimoto Y, Okano T, <u>Hagino H</u>	Etanercept promotes bone formation via suppression of Dickkopf-1 expression in rats with collagen-induced arthritis.	Yonago Acta Medica	56	13-19	2013
<u>Hagino H</u> , Takano T, Fukunaga M, Shiraki M, Nakamura T, Matsumoto T	Eldecalcitol reduces the risk of severe vertebral fractures and improves the health-related quality of life in patients with osteoporosis.	J Bone Miner Metab	31	183-189	2013
Nishizawa Y, Ohta H, Miura M, Inaba M, Ichimura S, Shiraki M, Takada J, Chaki O, <u>Hagino H</u> , <u>Fujiwara S</u> , Fukunaga M, Miki T, <u>Yoshimura N</u>	Guidelines for the use of bone turnover markers in the Diagnosis and Treatment of Osteoporosis (2012 Edition).	J Bone Miner Metab	31	1-15	2013
<u>Hagino H</u>	Eldecalcitol: newly developed active vitamin D(3) analog for the treatment of osteoporosis.	Expert Opin Pharmacother	14	817-825	2013
松本浩実、萩野浩	3軸加速度計歩行分析によるロコモティブシンドロームスクリーニングの妥当性について	運動器リハビリテーション			in press

谷村千華、森本美智子、萩野浩	外来通院にて保存的療法を受けている変形性膝関節症患者のセルフケア能力	日本看護科学会誌	33	42-51	2013
宮腰尚久、萩野浩、遠藤直人、山本智章、谷俊一	大腿骨近位部骨折に対する地域連携パスの運用実態—全国調査による地域差の検討—	整形・災害外科	56	991-998	2013
萩野浩	わが国における高齢者の大腿骨近位部骨折の現状と医療者の役割	医薬ジャーナル	49	867-871	2013
萩野浩	転倒予防	Osteoporosis Jpn	21	136-137	2013
萩野浩	骨粗鬆症の総論・疫学	Osteoporosis Jpn	21	118-119	2013
萩野浩	転倒の発生状況およびその危険因子	Osteoporosis Jpn	21	50-51	2013
萩野浩	骨粗鬆症における骨折の発生状況	Osteoporosis Jpn	21	40-41	2013
萩野浩、奥田玲子、山本陽子	骨折の二次予防を目指した治療戦略	内科	111	619-625	2013
萩野浩	大腿骨頸部/転子部骨折	総合リハ	41	251-256	2013
萩野浩、山本陽子	骨粗鬆症リエゾンサービスの現状と展望	整形・災害外科	56	375-383	2013
萩野浩、奥田玲子	骨粗鬆症の臨床像	日本臨牀	71, 増刊2	205-210	2013
萩野浩	リセドロネート	日本臨牀	71, 増刊2	289-294	2013
萩野浩	骨折の連鎖とその対策	日本臨牀	71, 増刊2	539-543	2013
萩野浩、奥田玲子、山本陽子	骨粗鬆症リエゾンサービスが担う多職種連携ネットワーク	Nursing BUSINESS	7	540-541	2013
萩野浩	骨代謝マーカーと骨折リスク	骨粗鬆症治療	12	95-101	2013
萩野浩	大腿骨近位部骨折	運動器リハビリテーション	24	12-17	2013
萩野浩	骨粗鬆症治療薬の現状と展望	BIO Clinica	28	929-933	2013
萩野浩	骨粗鬆症治療における活性型ビタミンD3製剤の位置づけ～新規活性型ビタミンD3誘導体に対する期待～	臨床リウマチ	25	207-210	2013
萩野浩	ビスホスホネート	HORMONE FRONTIER IN GYNECOLOGY	20	223-227	2013
萩野浩	骨粗鬆症	総合リハ	41	817-822	2013

萩野浩	ビスホスホネート	医学のあゆみ	247	97-100	2013
萩野浩、奥田玲子、山本陽子	骨粗鬆症についての基礎知識と予防・治療・ケアにおける最近の動向	臨牀看護	39	1812-1817	2013
萩野浩、山本陽子	骨粗鬆症の定義と成因（骨強度低下のメカニズム）	Geriatric Medicine	51	1017-1020	2013
萩野浩	骨粗鬆症治療におけるカルシトニンの位置づけ～最近のガイドラインより～	医薬ジャーナル	49	2638-2643	2013
萩野浩、奥田玲子	骨折リエゾンサービス	骨粗鬆症治療	12	211-213	2013
萩野浩、中野哲雄、藤野圭司	一座談会一骨粗鬆症による骨折を予防するために その1ーロコモティブシンドロームの現状と問題点ー	Pharma Medica	31	223-229	2013
萩野浩、中野哲雄、藤野圭司	一座談会一骨粗鬆症による骨折を予防するために その2ー大腿骨近位部骨折を中心にー	Pharma Medica	31	109-113	2013
宮腰尚久、今西康雄、山内美香、萩野浩	骨粗鬆症の骨折の連鎖を防ぐためにーテリパラチドの上手な使い方ー	Geriatric Medicine	51	1077-1087	2013
萩野浩	骨折連鎖を防ぐ治療戦略	MEDICAMENT NEWS	2121	6-7	2013
萩野浩	骨粗鬆症	クレデンシャル	61	5-11	2013
大橋暁、大西五三男、岡崎裕司、佐藤和強、松本卓也、別所雅彦、金子雅子、飛田健治、中村耕三、田中栄	創外固定の将来展望 CT/有限要素法解析を用いた仮骨強度の経時的予測	臨牀整形外科	48	241-246	2013
石橋英明、藤田博暁、細井俊希、新井智之、時村文秋、穴水依人、村木重之	高齢者におけるロコモーションチェックの運動機能予見性およびロコモーショントレーニングの運動機能増強効果の検証	運動器リハビリテーション	24	77-81	2013
Nishimura A, Fukuda A, Kato K, Fujisawa K, Uchida A, Sudo A.	Vascular safety during arthroscopic all-inside meniscus suture.	Knee Surg Sports Traumatol Arthrosc			in press

<u>Nishimura A</u> , Kato K, Fukuda A, Nakazora S, Yamada T, Uchida A, Sudo A.	Prevalence of hallux valgus and risk factors among Japanese community dwellers	J Orthop Sci.	19	257-262	2014
Fukuda A, <u>Nishimura A</u> , Kato K, Sudo A	Arthroscopically assisted minimally invasive plate osteosynthesis for posterior fracture-dislocation of the shoulder.	J Orthop Sci	19	194-197	2014
<u>Nishimura A</u> , Akeda K, Kato K, Asanuma K, Yamada T, Uchida A, Sudo A	Osteoporosis, vertebral fractures and mortality in a Japanese rural community.	Modern Rheumatology		http://informahealthcare.com/doi/abs/10.3109/14397595.2013.866921	2013
加藤祥、福田亜紀、 <u>西村明展</u> 、加藤公	陸上選手に生じた遠位大腿二頭筋腱皮下断裂の1例	整形外科	64	1379-1381	2013
稲谷則徒、佐久間雅久、坂口弘樹、松田和道、 <u>西村明展</u> 、加藤公、福田亜紀、藤澤幸三	中高年層における前十字靭帯再建術のスポーツ復帰に関する実態調査	東海スポーツ傷害研究会会誌	31	24-26	2013
<u>吉村典子</u>	大規模住民調査ROADスタディからみたロコモの疫学	整形外科ナーステ「超高齢社会における運動器医療とケア 'ロコモティブシンドローム」			in press
<u>吉村典子</u>	将来の自立度低下の予測におけるロコチェックの有用性：ROADスタディから	整形外科ナーステ「超高齢社会における運動器医療とケア 'ロコモティブシンドローム」			in press
<u>吉村典子</u>	ロコモティブシンドローム	日本臨牀	72	730-733	2014
<u>吉村典子</u>	ロコモとメタボと認知症—大規模住民調査が示すもの	日本医事新報	4679	105-110	2013
<u>吉村典子</u>	境界領域 知っておきたい 生活習慣病と運動器の障害 メタボとロコモ	臨床整形外科	48	146-149	2013
<u>吉村典子</u>	【図で見る骨粗鬆症2013】 骨粗鬆症の有病率と発生率	Osteoporosis Jpn	21	38-39	2013
<u>吉村典子</u>	【図で見る骨粗鬆症2013】 骨折発生率の地域差	Osteoporosis Jpn	21	42-43	2013

吉村典子、中村耕三、阿久根徹、藤原佐枝子、清水容子、吉田英世、大森豪、須藤啓広、西脇祐司、吉田宗人、下方浩史	【最新の骨粗鬆症学-骨粗鬆症の最新知見】大規模臨床試験の概要・住民コホート研究の概要 LOCOMOスタディ	日本臨牀	71,増刊2	642-645	2013
川口浩、阿久根徹、吉村典子	生活自立を指標とした生活習慣病の検査基準値 生活自立からみた生活習慣病の基準値 ロコモティブシンドローム 変形性関節症	日本老年医学会雑誌	50	191-193	2013
吉村典子	【健康づくりのための身体活動・運動と栄養-新しい身体活動指針とロコモティブシンドロームの予防-】ロコモティブシンドロームって何? メタボとの関連を中心に	日本栄養士学会雑誌	56	612-614	2013
帖佐悦男	ロコモ対策：学童期からの取り組み—なぜ子供の頃からロコモティブシンドローム(ロコモ) 予防が必要か—	Japanese Journal of Rehabilitation Medicine	51	113-119	2014
帖佐悦男、山口奈美、河原勝博、山本恵太郎	学校健診における運動器検診実施に向けて 学校医の立場から考える 学校健診における運動器検診の普及に向けて 宮崎方式 なぜ子供の頃からロコモティブシンドローム予防が必要か・課題とその対策	日本臨床スポーツ医学会誌	21	574-580	2013
帖佐悦男	ロコモティブシンドローム—地域への働きかけ—	整形外科	65	69-73	2014
渡邊信二、帖佐悦男	ロコモ予防②—宮崎県における対策—	関節外科	32	96-103	2013
帖佐悦男	第2次健康日本21スタート!!ロコモティブシンドローム予防活動レポート第2回宮崎県編	2013 Autumn Doctor's eye	8	62-65	2013
藤野圭司	【知る 診る 防ぐ!ロコモティブシンドローム】運動器不安定症 MADS	関節外科	32	1119-1124	2013
藤野圭司	運動器リハビリテーションと介護予防	日本医事新報	4678	56-57	2013

藤野圭司	骨の健康のために ロコモシヨントレーニング(ロコモ体操) サルコペニアの予防	O.li.v.e.	3	181-185	2013
藤野圭司	運動器の10年-ロコモティブシンドローム】ロコモティブシンドロームの概念	クリニシアン	60	594-601	2013
藤野圭司	卒後研修講座 ロコモティブシンドロームと介護予防	整形外科	64	479-486	2013
安村誠司、橋本万里	第7回ロコモティブシンドローム対策-ロコモコールの有効性	整形外科	64	1412-1415	2013
Kasukawa Y, Miyakoshi N, Ebina T, Aizawa T, Hongo M, Nozaka K, Ishikawa Y, Saito H, Chida S, <u>Shimada Y</u>	Effects of risedronate alone or combined with vitamin K2 on serum undercarboxylated osteocalcin and osteocalcin levels in postmenopausal osteoporosis.	J Bone Miner Metab			in press
Yoshikawa T, <u>Shimada Y</u> , Miyakoshi N, Matsunaga T, Hatakeyama K, Iwami T	Motion analysis of anterior inclination of the trunk while standing using a new three-dimensional musculoskeletal model combining the trunk and lower limbs.	Jpn J Compr Rehabil Sci	4	17-21	2013
Miyakoshi N, Hongo M, Mizutani Y, <u>Shimada Y</u>	Prevalence of sarcopenia in Japanese women with osteopenia and osteoporosis.	J Bone Miner Metab	31	556-561	2013
Ishikawa Y, Miyakoshi N, Kasukawa Y, Hongo M, <u>Shimada Y</u>	Spinal sagittal contour affecting falls: cut-off value of the lumbar spine for falls.	Gait Posture	38	260-263	2013
宮腰尚久、阿部栄二、村井肇、 <u>島田洋一</u>	骨粗鬆症性椎体骨折に対する手術療法	Osteoporosis Jpn	21	476-480	2013
齊藤公男、宮腰尚久、本郷道生、粕川雄司、 <u>島田洋一</u>	高齢者における坐位バランスの検討	日本脊髄障害医学会雑誌	26	132-133	2013
<u>島田洋一</u>	先端医用工学を応用した運動器リハビリテーション	日本整形外科学会雑誌	87	282-293	2013
本郷道生、宮腰尚久、 <u>島田洋一</u>	骨粗鬆症の疼痛管理理学療法(運動療法・物理療法)	日本臨牀	71,増刊2	426-429	2013

野坂光司、 <u>島田洋二</u> 、宮腰尚久、山田晋、本郷道生、粕川雄司、齊藤英知、木島泰明、木村善明、柏倉剛、櫻場乾	診断・検査 尿中ペントシジン値は骨粗鬆症性椎体骨折の重症度の予測マーカーになりうるか	別冊整形外科	63	134-137	2013
<u>石橋英明</u>	ロコモに対する運動療法 運動習慣のない中高年者に勧めるべき運動	日本医事新報	4679	97-104	2013
<u>石橋英明</u>	ロコモーショントレーニングの効果	整形外科	64	1217-1220	2013
<u>石橋英明</u>	ロコモティブシンドロームと転倒・骨折	Clinical Calcium	23	669-677	2013
Sasaki K, <u>Senda M</u> , Katayama Y, Ota H, Matsuyama Y	Characteristics of postural sway during quiet standing before and after the occurrence of neurogenic intermittent claudication in female patients with degenerative lumbar spinal canal stenosis.	J Phys Ther Sci	25	675-678	2013
<u>千田益生</u> 、 <u>堅山佳美</u> 、 <u>馬崎哲朗</u> 、 <u>上原健敬</u>	変形性膝関節症に対する運動療法の有効性	運動器リハビリテーション	24	275-278	2013
<u>千田益生</u> 、 <u>堅山佳美</u> 、 <u>馬崎哲朗</u> 、 <u>上原健敬</u>	人工筋肉の開発と臨床応用における課題	Locomotive Pain Frontier	2	50-52	2013
<u>千田益生</u> 、 <u>堅山佳美</u> 、 <u>馬崎哲朗</u> 、 <u>上原健敬</u>	ロコモ予防・治療ーロコトレ・ロコモ体操ー	関節外科	32	82-88	2013
<u>石田健司</u> 、 <u>永野靖典</u>	「知る 診る 防ぐ!ロコモティブシンドローム」ロコモ予防 高知県のある地域における対策	関節外科	32	1178-1183	2013
<u>石田健司</u>	第2次健康日本21スタート!! ロコモティブシンドローム 予防活動レポート	Doctor's eye	32	62-65	2013

IV. 研究成果の刊行物・別刷

ORIGINAL ARTICLE: SOCIAL RESEARCH,
PLANNING AND PRACTICE**Incidence of certified need of care in the long-term care insurance system and its risk factors in the elderly of Japanese population-based cohorts: The ROAD study**

Toru Akune,¹ Shigeyuki Muraki,¹ Hiroyuki Oka,² Sakae Tanaka,³ Hiroshi Kawaguchi,³ Fumiaki Tokimura,⁴ Hideyo Yoshida,⁵ Takao Suzuki,⁶ Kozo Nakamura⁷ and Noriko Yoshimura²

Departments of¹Clinical Motor System Medicine and ²Joint Disease Research, 22nd Century Medical & Research Center, Graduate School of Medicine, University of Tokyo, ³Department of Sensory & Motor System Medicine, Graduate School of Medicine, University of Tokyo, ⁴Department of Orthopaedic Surgery, Tokyo Metropolitan Geriatric Hospital, ⁵Research Team for Promoting Independence of the Elderly, Tokyo Metropolitan Institute of Gerontology, Tokyo, ⁶Research Institute, National Center for Geriatrics and Gerontology, Aichi, and ⁷National Rehabilitation Center for Persons with Disabilities, Saitama, Japan

Aim: To examine the incidence of certified need of care in the national long-term care insurance (LTCI) system, and to determine its risk factors in the elderly of Japanese population-based cohorts of the Research on Osteoarthritis/Osteoporosis Against Disability (ROAD) study.

Methods: Of the 3040 participants in the baseline examination of the ROAD study, we enrolled 1773 (699 men, 1074 women) aged 65 years or older who were not certified as in need of care level elderly at baseline. Participants were followed for incident certification of need of care in the LTCI system. Associated factors in the baseline examination with occurrence were determined by multivariate Cox proportional hazards regression analysis. Muscle dysfunction was defined in accordance with the European Working Group on Sarcopenia in Older People algorithm for screening sarcopenia.

Results: A total of 54 men and 115 women were certified as in need of care level elderly during the average 4.0-year follow up. The incidence was 2.0 and 2.5 per 100 person-years in men and women, respectively. Identified risk factors were region, age, body mass index <18.5 or ≥27.5 kg/m², grip strength, knee extension torque, usual gait speed, chair stand time and muscle dysfunction.

Conclusions: Both underweight and obesity, as well as low muscle strength and physical ability, are risk factors for certification of need of care. Considering muscle dysfunction is a risk factor for occurrence, screened individuals are recommended to receive early intervention programs regardless of muscle volume. **Geriatr Gerontol Int 2013; ●●: ●●-●●.**

Keywords: activities of daily living, certification of need of care (*youkaigo-nintei*), disability, long-term care insurance system, prospective cohort study.

Introduction

Japan is a super-aged society experiencing an unprecedented aging of the population. The proportion of the population aged 65 years or older was 23% in 2010, and

is expected to reach 30.1% in 2024 and 39% in 2051.¹ This leads to an increasing proportion of disabled elderly requiring support or long-term care, imposing enormous economic and social burdens on the country. The Japanese Government started the national long-term care insurance (LTCI) system in 2000 based on the Long-Term Care Insurance Act.² The aim was to certify need of care level elderly, and to provide suitable care services according to the level of care required (seven levels, including requiring support [levels 1 and 2] and requiring long-term care [levels 1–5]). The total number of certified in need of care level elderly was reported to be 5 million in 2011.²

Accepted for publication 12 August 2013.

Correspondence: Dr Toru Akune MD PhD, Department of Clinical Motor System Medicine, 22nd Century Medical and Research Center, Graduate School of Medicine, University of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo 113-8655, Japan. Email: akune-ort@h.u-tokyo.ac.jp

Certification of need of care in the national LTCI system is an important outcome in Japan, not only because of its massive social and economic burdens, but also because it is urgently required to reduce its risk and decrease the number of disabled elderly requiring care in their activities of daily living (ADL). For establishment of an evidence-based prevention strategy, it is critically important to accumulate epidemiological evidence including the incidence of certified need of care and identification of risk factors. However, there have been no studies to clarify the incidence of certified need of care in the LTCI system or its risk factors using large-scale, population-based cohorts.

In 2005, we started a large-scale, population-based cohort study entitled the Research on Osteoarthritis/Osteoporosis Against Disability (ROAD) study with a total of 3040 participants, which aims to elucidate the environmental and genetic backgrounds of musculoskeletal diseases.^{3,4} The present study investigated the incidence of certified need of care in the national LTCI system, and determined its risk factors using a database from the ROAD study.

Methods

Participants

The present analysis was based on data collected from cohorts established in 2005 for the ROAD study. Details of the cohorts have been reported elsewhere.^{3,4} Briefly, we created a baseline database from 2005–2007, which included clinical and genetic information on 3040 residents of Japan (1061 men, 1979 women). Participants were recruited from resident registration listings in three communities, namely, an urban region in Itabashi, Tokyo, and rural regions in Hidakagawa and Taiji, Wakayama. Participants in the urban region in Itabashi were recruited from those of a cohort study,⁵ in which participants were randomly drawn from the register database of Itabashi ward residents, with a response rate of 75.6% in the group aged >60 years. Participants in the rural regions in Hidakagawa and Taiji were recruited from resident registration lists, with response rates of 68.4% and 29.3%, respectively, in the groups aged >60 years. Inclusion criteria were the ability to: (i) walk to the survey site; (ii) report data; and (iii) understand and sign an informed consent form. For the present study, we enrolled 1773 participants (699 men, 1074 women; mean age 75.4 years) aged 65 years or older who were not certified as need of care level elderly in the national LTCI system at baseline. All participants provided written informed consent, and the study was carried out with approval from the ethics committees of the University of Tokyo and the Tokyo Metropolitan Institute of Gerontology.

Baseline procedures

Participants completed an interviewer-administered questionnaire containing 400 items that included lifestyle information, such as smoking habits, alcohol consumption and physical activity. At baseline, anthropometric measurements, including height and weight, were taken, and body mass index (BMI; weight [kg]/height² [m²]) was estimated based on the measured height and weight. Underweight was defined as BMI <18.5 and obesity as BMI ≥27.5, according to the 2004 consensus statement from the WHO regarding appropriate BMI for Asian populations.⁶ Grip strength was measured on bilateral sides using a handgrip dynamometer (TOEI LIGHT, Saitama, Japan); the higher measurement was recorded. Isometric peak knee extension torque was measured at a knee flexion angle of 90° using a dynamometer (GT-30; OG GIKEN, Okayama, Japan) twice in participants from the urban regional cohort (Itabashi, Tokyo); the higher measurement was recorded. The time taken to walk 6 m at usual walking speed in a hallway was recorded, and usual gait speed was calculated. Skeletal muscle dysfunction was defined as usual gait speed ≤0.8 m/s or grip strength <30 kg in men and <20 kg in women, according to the algorithm for screening sarcopenia recommended by the European Working Group on Sarcopenia in Older People (EWGSOP).^{7,8} The time taken for five consecutive chair rises without the use of hands was recorded in the rural regional cohorts (Hidakagawa and Taiji, Wakayama). Hands were folded in front of the chest with feet flat on the floor. Timing began with the command “Go”, and ended when the buttocks contacted the chair on the fifth landing.

Certification of need of care in the LTCI system

The nationally uniform criteria for long-term care need certification was established objectively by the Japanese Government, and certification of need of care level elderly is determined based on evaluation results by the Certification Committee for Long-term Care Need in municipalities in accordance with basic guidelines formulated by the Government. The process of eligibility for certification of need of care in the LTCI system was described in detail by Chen *et al.*⁹ An elderly person who requires help with ADL or the caregiver contacts the municipal Government to request official certification of care needs. After the application, a trained official visits the home to assess the current physical status of the elderly person, including the presence or absence of muscle weakness or joint contracture of limbs, and difficulties in sitting-up, standing-up, maintaining sitting or standing position, transferring from one place to another, standing on one leg, walking, bathing, dressing, and other ADL. Mental status, including dementia, is also assessed. These data are analyzed to calculate a

Table 1 Baseline characteristics of population at risk for certified need of care in the long-term care insurance system

	Entire cohort		Urban cohort		Rural cohort	
	Men	Women	Men	Women	Men	Women
No. participants	699	1,074	333	486	366	588
Age (years)	75.6 (5.1)	75.2 (5.3)	77.5 (3.7)	77.3 (3.8)	73.8 (5.5) [†]	73.5 (5.8) [†]
Height (cm)	160.9 (6.0)	147.9 (6.0)*	161.0 (5.8)	148.2 (5.4)*	160.8 (6.2)	147.7 (6.5)*
Weight (kg)	59.4 (9.1)	50.0 (8.3)*	59.4 (8.2)	49.8 (7.8)*	59.4 (9.9)	50.1 (8.8)*
BMI (kg/m ²)	22.9 (2.9)	22.8 (3.4)	22.9 (2.7)	22.7 (3.3)	22.9 (3.1)	22.9 (3.5)
BMI <18.5 (%)	6.2	8.0	6.1	7.9	6.3	8.0
BMI ≥27.5 (%)	5.7	9.3**	3.9	8.5**	7.4	9.9
Grip strength (kg)	30.4 (6.8)	19.4 (4.9)*	28.6 (6.1)	18.2 (4.1)*	31.9 (7.0) [†]	20.3 (5.2)** [†]
Knee extension torque (kgm)	–	–	79.6 (27.2)	54.8 (17.0)*	–	–
Usual gait speed (m/s)	1.17 (0.31)	1.10 (0.33)*	1.27 (0.24)	1.22 (0.24)*	1.08 (0.34) [†]	1.00 (0.36)** [†]
Chair stand time (s)	–	–	–	–	10.8 (3.7)	12.2 (5.4)*
Muscle dysfunction (%) [§]	48.7	56.0**	52.6	60.0**	45.2	52.6** [‡]
Smoking (%)	21.0	3.2**	19.2	3.0**	22.6	3.4**
Alcohol consumption (%)	61.2	23.0**	61.0	28.8**	61.3	18.4** [‡]

Except where indicated otherwise, values are mean (SD). **P* < 0.05 versus men in the corresponding group of the same cohort by unpaired Student's *t*-test. ***P* < 0.05 versus men in the corresponding group of the same cohort by χ^2 -test. [†]*P* < 0.05 versus urban cohort in the corresponding group of the same sex by unpaired Student's *t*-test. [‡]*P* < 0.05 versus urban cohort in the corresponding group of the same sex by χ^2 -test. [§]Muscle dysfunction was defined as usual gait speed ≤0.8 m/s or grip strength <30 kg in men and <20 kg in women. BMI, body mass index; LTCI, long-term care insurance system.

standardized score for determination of the level of care needs (certified support, levels 1–2; or long-term care, levels 1–5). In addition, the primary physician of the applicant assesses physical and mental status, including information on diseases causing ADL disability and the extent of disabilities caused by them. Finally, the Certification Committee for Long-term Care Need reviews the data and determines the certification and its level.

Follow up and definition of incident certified need of care

After the baseline ROAD survey, participants who were not certified as need of care level elderly at baseline were followed for incident certification of need of care in the LTCI system. Incident certified need of care was defined as the incident certified 7 level, including requiring support (levels 1–2) and requiring long-term care (levels 1–5). Information on the presence or absence of certification of need of care and its date of occurrence were collected by the resident registration listings in three communities every year up to 2010, and were used for analyses in the present study.

Statistical analysis

All statistical analyses were carried out using STATA statistical software (STATA, College Station, TX, USA).

Differences in the values of the parameters between two groups were tested for significance using the non-paired Student's *t*-test and χ^2 -test. Factors associated with occurrence of certified need of care were determined using Cox proportional hazards regression analysis; hazard ratios (HR) and 95% confidence intervals (CI) were determined after adjusting for region, age, sex, and BMI.

Results

Of the 1773 participants who were not certified as in need of care level elderly at baseline, information on certification of need of care could be obtained in 1760 (99.3%) during the average 4.0-year follow up. A total of 54 men and 115 women were certified as in need of care level elderly in the national LTCI system; whereas, 1591 remained uncertified during the follow-up period. A total of 126 participants died, and eight moved away.

Table 1 shows the baseline characteristics of the population at risk for occurrence of certified need of care in the LTCI system. Although BMI was not significantly different between men and women in the entire, urban or rural cohorts, prevalence of obesity (BMI ≥27.5) was significantly higher in women than in men in the entire and urban cohorts. The prevalence of underweight was higher in women than in men in the entire,

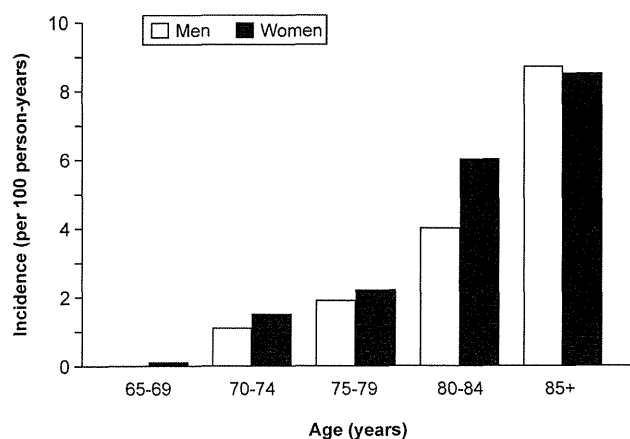


Figure 1 Incidence of certified need of care in the long-term care insurance system in men and women in each age stratum.

urban and rural cohorts; however, there was no significant difference. The prevalence of skeletal muscle dysfunction, determined by gait speed and grip strength, was significantly higher in women than in men in the entire, urban and rural cohorts.

Figure 1 shows sex- and age-distributions of the incidence of certified need of care in the LTCI system. Incidence was 2.3/100 person-years in the overall population of the entire cohort, and 2.0/100 person-years in men and 2.5/100 person-years in women. The incidence was very low in the age-stratum of 65–69 years, whereas, it tended to be markedly higher in the age-strata of 80 years and older in both sexes.

We then determined the risk factors for occurrence of certified need of care in the LTCI system. First, analysis was carried out using region, age, sex and BMI as explanatory variables in the Cox proportional hazards regression model (upper part of Table 2). Rural region and age were found to be risk factors for occurrence of certified need of care in the overall population. Sex and BMI were not significantly different. To further investigate the association between BMI and occurrence, we categorized BMI into three groups. Both underweight (BMI <18.5) and obesity (BMI ≥27.5) were found to be risk factors for occurrence of certified need of care, showing a U-shaped association. As for muscle strength and physical performance, handgrip strength, knee extension torque, usual gait speed, chair stand time and muscle dysfunction were found to be significantly associated with occurrence of certified need of care (lower part of Table 2). We carried out the same analyses in men and women separately (Table 2), and found results similar to those of the overall population.

Discussion

The present study investigated the incidence of certified need of care in the national LTCI system, and

Table 2 Hazard ratios and 95% confidence intervals for occurrence of certified need of care in the long-term care insurance system

	Overall population	Men	Women
	Crude HR (95% CI)	Crude HR (95% CI)	Crude HR (95% CI)
Region (rural vs urban)	1.15 (0.83–1.59)	1.13 (0.65–1.96)	1.15 (0.77–1.72)
Age (+1 year)	1.17 (1.13–1.20)	1.19 (1.12–1.26)	1.16 (1.12–1.20) ^b
Sex (women vs men)	1.25 (0.90–1.74)	–	–
BMI (+1 kg/m ²)	0.98 (0.93–1.03)	0.93 (0.84–1.02)	1.00 (0.94–1.06) ⁱ
≥18.5 or <27.5	1 (Reference)	1 (Reference)	1 (Reference)
BMI <18.5	2.10 (1.31–3.38)	2.43 (1.09–5.40)	1.93 (1.07–3.48)
BMI ≥27.5	1.82 (1.13–2.93)	1.39 (0.50–3.87)	1.92 (1.12–3.29)
Grip strength (+1 kg)	0.93 (0.91–0.95)	0.91 (0.87–0.95)	0.89 (0.85–0.92)
Knee extension torque (+1 kgm)	0.97 (0.96–0.99)	0.97 (0.95–0.99)	0.97 (0.95–0.99)
Usual gait speed (+0.1 m/s)	0.80 (0.77–0.85)	0.81 (0.74–0.88)	0.80 (0.76–0.85)
Chair stand time (+1 s)	1.09 (1.07–1.12)	1.18 (1.10–1.27)	1.09 (1.06–1.11)
Muscle dysfunction (yes vs no) ^a	2.91 (2.02–4.19)	2.60 (1.45–4.68)	3.07 (1.92–4.92)
Smoking (yes vs no)	0.98 (0.58–1.68)	1.18 (0.62–2.26)	0.95 (0.30–2.99)
Alcohol consumption (yes vs no)	0.71 (0.50–0.99)	0.78 (0.45–1.35)	0.70 (0.42–1.16)
	Adjusted HR (95% CI)	Adjusted HR (95% CI)	Adjusted HR (95% CI)
Region (rural vs urban)	1.61 (1.17–2.24) ^b	1.64 (0.94–2.86) ^g	1.59 (1.07–2.38) ^g
Age (+1 year)	1.17 (1.14–1.21) ^c	1.19 (1.13–1.26) ^h	1.16 (1.12–1.21) ^h
Sex (women vs men)	1.24 (0.89–1.73) ^d	–	–
BMI (+1 kg/m ²)	1.01 (0.96–1.06) ^e	0.96 (0.88–1.06) ⁱ	1.02 (0.97–1.08) ⁱ
≥18.5 or <27.5	1 (Reference)	1 (Reference)	1 (Reference)
BMI <18.5	1.77 (1.10–2.84) ^e	2.43 (1.09–5.40)	1.79 (0.99–3.22) ⁱ
BMI ≥27.5	2.12 (1.32–3.43) ^e	1.39 (0.50–3.87)	2.18 (1.27–3.75) ⁱ
Grip strength (+1 kg)	0.94 (0.91–0.97) ^f	0.91 (0.87–0.95)	0.94 (0.89–0.98) ⁱ
Knee extension torque (+1 kgm)	0.97 (0.96–0.99) ^f	0.97 (0.95–0.99)	0.97 (0.95–1.00) ⁱ
Usual gait speed (+0.1 m/s)	0.84 (0.79–0.90) ^f	0.81 (0.74–0.88)	0.85 (0.78–0.92) ⁱ
Chair stand time (+1 s)	1.06 (1.03–1.10) ^f	1.18 (1.10–1.27)	1.06 (1.02–1.09) ⁱ
Muscle dysfunction (yes vs no) ^a	1.71 (1.16–2.52) ^f	2.60 (1.45–4.68)	1.72 (1.04–2.85) ⁱ
Smoking (yes vs no)	1.39 (0.79–2.43) ^f	1.18 (0.62–2.26)	1.09 (0.35–3.47) ⁱ
Alcohol consumption (yes vs no)	0.83 (0.58–1.21) ^f	0.78 (0.45–1.35)	0.76 (0.46–1.27) ⁱ

^aMuscle dysfunction was defined as usual gait speed ≤0.8 m/s or grip strength <30 kg in men and <20 kg in women. ^bAdjusted for age, sex and body mass index (BMI). ^cAdjusted for region, sex and BMI. ^dAdjusted for region, age and BMI. ^eAdjusted for region, age, sex and BMI. ^fAdjusted for region and BMI. ^gAdjusted for region and BMI. ^hAdjusted for region and BMI. ⁱAdjusted for region and age. ^jAdjusted for region, age and BMI. Urban region and men were used as references. CI, confidence interval; HR, hazard ratio.

determined its risk factors using Japanese population-based cohorts. Identified risk factors were region, age, underweight, obesity, handgrip strength, knee extension torque, usual gait speed, chair stand time and muscle dysfunction (determined by the EWGSOP algorithm for screening sarcopenia).

In the present study, we could not obtain information on causes of certified need of care in the LTCI system. Therefore, we could not analyze the direct association of each causing condition with such factors as anthropometric and physical performance measurements. The Government of Japan reported that the top five leading causes of certified need of care were cerebral stroke, dementia, asthenia as a result of older age, joint disease and fall-related fracture, comprising 71.6% of all causes in 2010.¹⁰ Based on these data, most of the causes of incident certification in the present study are inferred to be among the top five leading conditions.

Both low and high BMI were found to be risk factors for occurrence of certified need of care, showing an overall U-shaped association. This U-shaped association is similar to that between BMI and risk of death.^{11,12} The association between risk of death from cardiovascular disease and other causes, and BMI was reported to be U-shaped in East Asians,¹¹ whereas the risk of all-cause mortality versus BMI was also found to have a U-shaped association in Western European and North American populations.¹² High BMI is an established risk factor for chronic diseases, including hypertension, dyslipidemia and diabetes mellitus, which increase the risk of cerebral stroke.¹³ High BMI is also a major risk factor for knee osteoarthritis,¹⁴⁻¹⁷ which can cause ADL disability in the elderly.¹⁸ In contrast, low BMI is an established risk factor for osteoporosis and related fracture.¹⁹ It also might relate to asthenia, a condition of loss or lack of bodily strength as a result of chronic wasting disease. Underweight as a result of malnutrition or sarcopenia is suggested to be included in this category.

Other identified risk factors were handgrip strength, knee extension torque, usual gait speed, chair stand time and muscle dysfunction (determined by the EWGSOP algorithm for screening sarcopenia). Previous studies have reported that low muscle strength and physical performance were predictors of subsequent ADL disability in the elderly.²⁰⁻²³ The results of the present study are consistent with these previous reports. As many of the performance tests used in the present study are easy to carry out and evaluate, they can be utilized for screening elderly persons at high risk of certified need of care in the LTCI system. Those who were classified as having muscle dysfunction in the present study were at high risk of sarcopenia as well as certified need of care, regardless of muscle volume. Therefore, elderly persons screened by the EWGSOP algorithm are recommended to receive early interven-

tion programs for prevention of ADL disability and subsequent deterioration leading to certified need of care.

The Japanese Orthopedic Association proposed the concept of "locomotive syndrome" in 2007 for the promotion of preventive health care of locomotive organs.²⁴⁻²⁶ Locomotive syndrome refers to conditions under which the elderly have been receiving support or long-term care, or high-risk conditions under which they might soon require support or long-term care, that are caused by musculoskeletal disorders.²⁴⁻²⁶ Functional declines in locomotive organs, including muscle strength, walking speed and balancing ability, usually progress slowly and gradually. As such, it might be difficult for people to recognize this decline in their daily life. Therefore, it is of particular importance to raise awareness of the growing risk caused by these disorders, and to take action to improve and maintain the health of locomotive organs. Population approaches, including promotion of the concept of locomotive syndrome to both younger and older generations, are important, in addition to high-risk approaches, including identifying those at risk for certified need of care and practicing intervention programs to reduce the risk of certified need of care.

There were some limitations in the present study. As we could not obtain information on causing conditions, we could not determine the risk factors for occurrence of certified need of care with respect to each causing condition. Additional studies are necessary to identify those direct associations. In the present study, the rural region was at higher risk of incident certified need of care compared with the urban region. The reasons for this could include differences in available public and private transportation or delivery services regarding meals and commodities for the elderly. In addition to these, the threshold between certified and non-certified elderly might be different among municipalities, which could lead to regional differences. Although the Certification Committee for Long-term Care Need in each municipality determines certification in accordance with guidelines formulated by the Government, the Committee also has to consider assessment by the applicant's primary physician and objective evaluation results regarding physical and mental status, which could affect the threshold of certification. Another limitation was health bias. Participants at baseline in the present study were those who could walk to the survey site, and could understand and sign an informed consent form. As those who could not were not included in the analyses, the study participants do not truly represent the general population due to health bias. Therefore, incidence of certified need of care was most likely underestimated, which should be taken into consideration when generalizing the results of the present study.

In conclusion, the present study revealed the incidence of certified need of care in the national LTCI