

EDITORIAL

GERIATRICS IN THE 21ST CENTURY

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Over this century we can expect to see older persons live longer, be more resilient and less frail.

Research and care have been built to identify and treat diseases, but not to maintain functional capacities (eg, mobility, cognition, immune functions, etc.) during aging. As a consequence, individuals do not receive the healthcare they need to prevent/delay the onset of dependency (an almost irreversible and economically burdensome condition). For the W.H.O (1, 2), healthy aging is not a life without diseases, we have diseases at any age, but it is a life where we are able to maintain the functions we need to be able to do what we value.

To make it possible we will have to:

- identify biological profiles predictive of functional loss, and to discover, validate, and implement innovative rejuvenative strategies for delaying age-related functional loss (3);
- to increase functional reserves in early aging (50-70yrs) and prevent declines in functions and recover impaired functions in late aging (70 yrs or over);
- to translate the innovative procedures, tools and products into a new care model for aging populations using new technologies (ICT solutions);

One of the tasks of the geriatrician will be to undertake the stewardship of the emerging “senolytics” and determine for whom and at what stage prescribing these drugs is appropriate (4). Clustered Regularly Interspaced Short Palendromic Repeats (CRISPR/Cas9) genomic editing will be mainly used to eradicate congenital diseases at the embryonic stage before birth, but using an adenovirus vector, techniques will emerge to treat sarcopenia, frailty and dementia in older persons (5). This is already being done for the treatment of some cancers (6). An example that should develop over the next decade is using CRISPR/Cas9 to silence the myostatin gene (7). The rapid development of biological drugs will require the geriatrician to be an expert on these emerging drugs and their side-effects, e.g., antibodies against myostatin or activin receptors to treat sarcopenia (8). Geriatricians are already aware of the problems produced by polypharmacy and inappropriate drug use in older persons (9-17), and this will only become worse with the interactions with biologics which will only become obvious after many years of use. All of this will drive geriatricians to become prime users of personalized (P4) medicine (i.e., predictive, preventive, personalized and participatory), assisted by computers (18).

The other area in which geriatricians will need to develop new skills will be in disruptive technology (19-21). The ability of older persons to “age-in-place” will be highly dependent on home electronic monitoring and the availability of robots such as “companionable” (22-24). Exoskeletons and other devices will allow persons who are functionally impaired to be able to continue to function (25-27). Telemedicine will become central to providing home care (28-30). Entertainment robots, such as Paro and Aibo (31-34) and exercise robotic trainers will become important for elder care (35).

Many geriatricians will focus on being geriatric hospitalists providing care for persons over 70 years in hospital, balancing the need for maintaining function as well as treating disease, as is done in Acute Care for the Elderly (ACE) units (36). Geriatricians will play a key role in enhancing care for older persons with hip fractures (37-40), trauma (41, 42), delirium, utilizing Delirium Intensive Care Units and other techniques (43-46), and stroke patients (47, 48). Working with dietitians they will have a specific role on preventing and treating undernutrition and cachexia in the hospital setting (49-53).

Modern Geriatric Giants

A major role of the geriatrician will be to train family practitioners to recognize and where possible provide care for the major geriatric syndromes, i.e., frailty, sarcopenia, anorexia of aging and cognitive dysfunction (54). Already a number of approaches have been developed to increase awareness of these syndromes (55, 56). These approaches include the Kihon Index (57, 58), EasyCare (59, 60), Vulnerable Elder Survey (61), the Gerontopole Frailty Index (62-65), and the Rapid Geriatric Assessment (66, 67).

-Frailty has become central to geriatric syndromes, either as the physical phenotype (68, 69), or as the Frailty Co-morbidity Index (70, 71). Studies have suggested that exercise and nutrition interventions can improve outcomes in frail older persons (72-75). A rapid screen – the FRAIL – can be utilized both in hospitals (76, 77) and in the outpatient setting (78-81). A computerized algorithm has been developed to allow health professionals to recognize and treat frailty (82). The Asia Pacific Conference has developed guidelines for the treatment of frailty (83). A Mediterranean diet and polyphenols appear to decrease the chance of developing frailty (84-87).

A number of definitions for sarcopenia have been developed.

They all recognize that it consists of poor function (walking speed or grip function) in the presence of low muscle mass (88-93). The primary treatment consists of resistance exercise (94-98). Leucine enriched essential amino acids (whey protein) or possibly hydroxymethyl butyrate are the treatment of choice to act synergistically with exercise through direct stimulation of mTOR (99-103). The SARC-F is a quick screen that is available for use by primary care professionals (104-107).

It is now well recognized that the anorexia of aging puts older persons at risk for weight loss and undernutrition (108,109). Numerous studies have shown that the MNA is an excellent screening test for malnutrition (110-118). The SNAQ has been shown to be a reasonable test to predict anorexia and identify persons at risk of weight loss (119-122). The MEALS-ON-WHEELS mnemonic provides the major reversible causes of weight loss (123). Cachexia is predominantly due to inflammatory cytokines (124, 125). It can be recognized, using the Glasgow Cachexia Scale, by finding a low albumin and an elevated CRP (126). Anamorelin, a ghrelin agonist, increases food intake and muscle mass but not function in persons with cachexia (127).

There are numerous causes of cognitive dysfunction and dementia. The three most common causes of dementia are Alzheimer's disease (45%), vascular dementia (32%) and Lewy-Body Dementia (10%) (128). There are a number of reversible causes of mild cognitive impairment and early dementia (129). A Mediterranean diet with extra virgin olive oil delays the loss of cognition and may prevent Alzheimer's disease (130-132). A number of other nutritional approaches have been tried with limited success (133-136). Dementia has decreased in the USA most probably because of increased treatment of cardiovascular risk factors (137). At present, the drugs available to treat Alzheimer's disease have been somewhat disappointing. With the new imaging techniques giving an improved diagnosis of Alzheimer's diseases, it is hoped that new drugs will be developed to improve treatment. Antisenses (oligonucleotides) to Amyloid Precursor Protein are one class of drug with positive effects in animals that have yet to be tested in humans (138, 139). The recent recognition of the "diabetic brain" as a unique cause of cognitive loss opens up the possibility of new drugs to treat this condition (140). The Rapid Cognitive Screen (RCS) has been shown to be an excellent, quick screening test for mild cognitive impairment and dementia (141). Cognitive Stimulation Therapy has shown promise in treating moderate dementia (142-145). The recognition and management of cognitive frail will be a major area in this century (146-152).

Long-Term Care

The improvement of the quality of care and long-term care research, as well as better recognition for the health care professionals who work in this arena is clearly an important role of the geriatrician (153, 154). A research agenda has been set by

the IAGG-GARN nursing home group (155). The FRAIL-NH has been shown to be an excellent tool for recognizing those at major risk of poor outcomes (156). The use of advanced practice nurses in this arena is likely to greatly improve quality of care (157). It has been suggested that nursing homes may be excellent venues to provide exercise therapy and other support for community living adults (158).

Conclusion

It is likely that this century will produce many exciting and unimagined improvements in care for the aging population. As an example, in 1917, no one imagined the existence of penicillin which was only discovered 11 years later. Geriatricians will need to keep up to date with numerous biochemical and pharmaceutical studies while continuing to recognize the need to focus on person centered care and to develop new systems, if we are to remain the "Superspecialists" that we are today (159). It is to be hoped that this century will be "the best of times...an epoch of incredulity...and a spring of hope."

It is our hope that the Journal of Nutrition Health and Aging will be a beacon leading geriatricians and other health professionals into this exciting new world which will increase resilience and decrease frailty in the aging population.

References

1. Beard JR, Officer A, de Carvalho IA, Sadana R, Pot AM, Michel JP, et al. The World Report on Ageing and Health: A policy framework for healthy ageing. *Lancet* 2016;387(10033):2145-2154.
2. World Health Organization, 2017. Integrated Care for Older People: Guidelines on Community-level interventions to manage declines in intrinsic capacity. Geneva: World Health Organization. License CC BY-NC-SA 3.0 IGO.
3. Eming SA, Synn TA, Martin P. Inflammation and metabolism in tissue repair and regeneration. *Science* 2017;256: 1026-1030.
4. Kirkland JL, Tchkonja T, Zhu Y, et al. (2017) The clinical potential of senolytic drugs. *J Am Geriatr Soc* Sep 2017;. Doi:10.1111/jgs.14969 [Epub ahead of print].
5. Musunuru K. The hope and hype of CRISPR-Cas9 genome editing: A review. *JAMA Cardiol* 2017;2(8):914-919.
6. Liu C, Zhang L, Liu H, Cheng K. Delivery strategies of the CRISPR-Cas9 gene-editing system for therapeutic applications. *J Control Release* 2017;Sep 11. Doi:10.1016/j.jconrel.2017.09.012 [Epub ahead of print].
7. Wei Y, Chen Y, Qiu Y, Zhao H, Liu G, Zhang Y, et al. Prevention of muscle wasting by CRISPR/Cas9-mediated disruption of myostatin in vivo. *Mol Ther* 2016;24:1889-1891.
8. Vellas B, Fielding R, Bhasin S, et al. Sarcopenia trials in specific diseases: Report by the international conference on frailty and sarcopenia research task force. *J Frailty Aging* 2016;5(4):194-200.
9. Rolland Y, Morley JE. Editorial: Frailty and polypharmacy. *J Nutr Health Aging* 2016;20:645-646.
10. Veronese N, Stubbs B, Noale M, et al. Polypharmacy is associated with higher frailty risk in older people: An 8-year longitudinal cohort study. *J Am Med Dir Assoc* 2017;18:624-628.
11. Cherubini A, Corsonello A, Lattanzio F. Polypharmacy in nursing home residents: What is the way forward? *J Am Med Dir Assoc* 2016;17:4-6.
12. Poudel A, Peel NM, Nissen LM, et al. Adverse outcomes in relation to polypharmacy in robust and frail older hospital patients. *J Am Med Dir Assoc* 2016;17:767.e9-767.e13.
13. Morley JE. Inappropriate drug prescribing and polypharmacy are major causes of poor outcomes in long-term care. *J Am Med Dir Assoc* 15(11):780-782.
14. Jokanovic N, Tan EC, Dooley MJ, et al. Prevalence and factors associated with polypharmacy in long-term care facilities: A systematic review. *J Am Med Dir Assoc* 2015;6:535.e1-12.
15. Little MO, Morley A. Reducing polypharmacy: Evidence from a simple quality improvement initiative. *J Am Med Dir Assoc* 2013;14:152-156.

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16. Morley JE. Polypharmacy in the nursing home. *J Am Med Dir Assoc* 2009;10:289-291.
17. Schepisi R, Fusco S, Sganga F, Falcone B, Vetrano DL, Abbatecola A, et al. Inappropriate use of protein pump inhibitors in elderly patients discharged from acute care hospitals. *J Nutr Health Aging* 2016;20:665-670.
18. Morley JE, Vellas B. Patient-centered (P4) medicine and the older person. *J Am Med Dir Assoc* 2017;18(6):455-459.
19. Michel JP, Franco A. Geriatricians and technology. *J Am Med Dir Assoc* 2014;15:860-862.
20. Piau A, Campo E, Rumeau P, et al. Aging society and gerontechnology: A solution for an independent living? *J Nutr Health Aging* 2014;18(1):97-112.
21. Mulvenna M, Hutton A, Coates V, et al. Views of caregivers on the ethics of assistive technology used for home surveillance of people living with dementia. *Neuroethics* 2017;10:255-266.
22. Lattanzio F, Abbatecola AM, Bevilacqua R, et al. Advanced technology care innovation for older people in Italy: Necessity and opportunity to promote health and wellbeing. *J Am Med Dir Assoc* 2014;15:457-466.
23. Rantz M, Phillips LJ, Galambos C, et al. Randomized trial of intelligent sensor system for early illness alerts in senior housing. *J Am Med Dir Assoc* 2017;Jul 12. Doi: 10.1016/j.jamda.2017.05.012 [Epub ahead of print].
24. Little MO, Rantz M, Lynn GA. Health information technology in long-term care: Potential for the future. *J Am Med Dir Assoc* 2016;17:379-380.
25. Lattanzio F, Abbatecola AM, Bevilacqua R, et al. Advanced technology care innovation for older people in Italy: Necessity and opportunity to promote health and wellbeing. *J Am Med Dir Assoc* 2014;15:457-466.
26. Hall A, Wilson CB, Stanmore E, Todd C. Implementing monitoring technologies in care homes for people with dementia: A qualitative exploration using Normalization Process Theory. *Int J Nurs Stud* 2017;72:60-70.
27. Lee DJ, Bae SJ, Jang SH, Chang PH. Design of a clinically relevant upper-limb exoskeleton robot for stroke patients with spasticity. *IEEE Int Conf Rehabil Robot Jul;2017:622-627*. Doi: 10.1109/ICORR.2017.8009317.
28. Morley JE. Telemedicine: Coming to nursing homes in the near future. *J Am Med Dir Assoc* 2016;17:1-3.
29. Hui E, Woo J, Hjelm M, et al. Telemedicine: A pilot study in nursing home residents. *Gerontology* 2001;47:82-87.
30. Volicer L. Nursing home telepsychiatry. *J Am Med Dir Assoc* 2015;16:7-8.
31. Banks WA. Artificial emotions: Robots caring for the elderly. *J Am Med Dir Assoc* 2013;14:635-636.
32. Moyle W, Jones CJ, Murfield JE, et al. Use of a robotic seal as a therapeutic tool to improve dementia symptoms: A cluster-randomized controlled trial. *J Am Med Dir Assoc* 2017;18:766-773.
33. Bemelmans R, Gelderblom GJ, Jonker P, de Witte L. Socially assistive robots in elderly care: A systematic review into effects and effectiveness. *J Am Med Dir Assoc* 2012;13:114-120.e1.
34. Egan KJ, Pot AM. Encouraging innovation for assistive health technologies in dementia: Barriers, enablers and next steps to be taken. *J Am Med Dir Assoc* 2016;17:357-363.
35. Aoyagi D, Ichinose WE, Harkema SJ, Reinkensmeyer DJ, Bobrow JE. A robot and control algorithm that can synchronously assist in naturalistic motion during body-weight-supported gait training following neurologic injury. *IEEE Trans Neural Syst Rehabil Eng* 2007;15:387-400.
36. Landefeld CS, Palmer RM, Kresevic DM, Fortinsky RH, Kowal J. A randomized trial of care in a hospital medical unit especially designed to improve the functional outcomes of acutely ill older patients. *N Engl J Med* 1995;332:1338-1344.
37. Abrahamsen C, Norgaard B, Draborg E, Nielsen D. Reflections on two years after establishing an orthogeriatric unit: A focus group study of healthcare professionals' expectations and experiences. *BMC Health Serv Res* 2017;17(1):602. Doi: 10.1186/s12913-017-2550-3.
38. Förch S, Kretschmer R, Haufe T, Plath J, Mayr E. Orthogeriatric combined management of elderly patients with proximal femoral fracture: Results of a 1-year follow-up. *Geriatr Orthop Surg Rehabil* 2017;8:109-114.
39. Folbert EC, Hegeman JH, Gierveld R, van Netten JJ, Velde DV, Ten Duis HJ, Slaets JP. Complications during hospitalization and risk factors in elderly patients with hip fracture following integrated orthogeriatric treatment. *Arch Orthop Trauma Surg* 2017;137:507-515.
40. Abrahamsen C, Norgaard B, Draborg E. Health care professionals' readiness for an interprofessional orthogeriatric unit: A cross-sectional survey. *Int J Orthop Trauma Nurs* 2017;26:18-23.
41. Brooks SE, Peetz AB. Evidence-based care of geriatric trauma patients. *Sur Clin North Am* 2017;97:1157-1174.
42. Caterino JM, Brown NV, Hamilton MW, Ichwan B, Khalidina S, Evans DC, et al. Effect of geriatric-specific trauma triage criteria on outcomes in injured older adults: A statewide retrospective cohort study. *J Am Geriatr Soc* 2016;64:1944-1951.
43. Flaherty JH, Yue J, Rudolph JL. Dissecting delirium: Phenotypes, consequences, screening, diagnosis, prevention, treatment, and program implementation. *Clin Geriatr Med* 2017;33:393-413.
44. Flaherty JH, Morley JE. Delirium in the nursing home. *J Am Med Dir Assoc* 2013;14:632-634.
45. Flaherty JH, Steele DK, Chibnall JT, et al. An ACE unit with a delirium room may improve function and equalize length of stay among older delirious medical inpatients. *J Gerontol A Biol Sci Med Sci* 2010;65:1387-1392.
46. Flaherty JH, Tariq SH, Raghavan S, Bakshi S, Moineddin A, Morley JE. A model for managing delirious older inpatients. *J Am Geriatr Soc* 2003;51:1031-1035.
47. Lindley RI, Amayo EO, Marshall J, Sandercock PA, Dennis M, Warlow CP. Hospital services for patients with acute stroke in the United Kingdom: The stroke Association Survey of consultant opinion. *Age Ageing* 1995;24:525-532.
48. Leibovitz A, Lubart E, Rabinovich H, Baumohl L, Platinovich N, Habor B. A 10-year perspective on the patients referred to a geriatric rehabilitation complex: The influence of managed care. *J Am Med Dir Assoc* 2001;2:1-3.
49. Holyday M, Daniells S, Bare M, Caplan GA, Petocz P, Bolin T. Malnutrition screening and early nutrition intervention in hospitalised patients in acute aged care: A randomised controlled trial. *J Nutr Health Aging* 2012;16:562-568.
50. O'Shea E, Trawley S, Manning E, Barrett A, Browne V, Timmons S. Malnutrition in hospitalized older adults: A multicenter observational study of prevalence, associations and outcomes. *J Nutr Health Aging* 2017;21:830-836.
51. Whitley A, Skliros E, Graven C, McIntosh R, Lasry C, Newsome C, Bowie A. Changes in nutritional and functional status in longer stay patients admitted to a geriatric evaluation and management unit. *J Nutr Health Aging* 2017;1:686-691.
52. Frangos E, Trombetti A, Graf CE, Lachat V, Samaras N, Vischer UM, et al. Malnutrition in very old hospitalized patients: A new etiologic factor of anemia? *J Nutr Health Aging* 2016;20:705-713.
53. Martin A, Ruiz E, Sanz A, Garcia JM, Gomez-Candela C, Burgos R, Matia P, Ramalle-Gomera E. Accuracy of different mini nutritional assessment reduced forms to evaluate the nutritional status of elderly hospitalised diabetic patients. *J Nutr Health Aging* 2016;20:370-375.
54. Morley JE. Frailty and sarcopenia: The new geriatric giants. *Rev Invest Clin* 2016;68:59-67.
55. Morley JE. Rapid Geriatric assessment: Secondary prevention to stop age-associated disability. *Clin Geriatr Med* 2017;3:431-440.
56. Morley JE, Arai H, Cao L, Dong B, Merchant RA, Vellas B, et al. Integrated care: Enhancing the role of the primary health care professional in preventing functional decline: A systematic review. *J Am Med Dir Assoc* 2017;18:489-494.
57. Yamada Y, Nanri H, Watanabe Y, Yoshida T, Yokoyama K, Itoi A, et al. Prevalence of frailty assessed by Fried and Kihon checklist indexes in a prospective cohort study: Design and demographics of the Kyoto-Kameoka Longitudinal study. *J Am Med Dir Assoc* 2017;18:733.e7-733.e15.
58. Kera T, Kawai H, Yoshida H, Kirano H, Kojima M, Fujiwara Y, et al. Classification of frailty using the Kihon checklist: A cluster analysis of older adults in urban areas. *Geriatr Gerontol Int* 2017;17:69-77.
59. Brandao MP, Martins L, Philp I, Cardoso MF. Reliability and validity of the EASYCare-2010 standard to assess elderly people in Portuguese primary health care. *Aten Primaria Apr* 2017;5; doi: 10.1016/j.aprim.2016.11.016 [Epub ahead of print].
60. Geessink NH, Schoon Y, Olde Rikkert MG, Melis RJ. Criterion validity of a frailty index derived from the Easycare instrument. *J Am Geriatr Soc* 2017;65:222-224.
61. Arora VM, Johnson M, Olson J, Podrazik PM, Levine S, Dubeau CE, et al. Using assessing care of vulnerable elders quality indicators to measure quality of hospital care for vulnerable elders. *J Am Geriatr Soc* 2007;55:1705-1711.
62. Vellas B. Implementing frailty screening, assessment, and sustained intervention: The experience of the Gerontopole. *Vellas B. J Nutr Health Aging* 2015;19:673-680.
63. Tavassoli N, Guyonnet S, Van Kan GA, et al. Description of 1,108 older patients referred by their physician to the "Geriatric Frailty Clinic (GFC) for assessment of frailty and prevention of disability" at the Gerontopole. *J Nutr Health Aging* 2014;18(5):457-464.
64. Vellas B, Balardy L, Gillette-Guyonnet S, et al. Looking for frailty in community-dwelling older persons: The Gerontopole frailty screening tool (GFST). *J Nutr Health Aging* 2013;17(7):629-631.
65. Fougere B, Sirois MJ, Carmichael PH, Batomen-Kuimi BL, Chicoula B, Escourrou E, et al. (General practitioners' clinical impression in the screening for frailty: Data from the FAP study pilot. *J Am Med Dir Assoc* 2017;18:193.e1-193.e5.
66. Morley JE, Cao L. (Rapid screening for sarcopenia. *J Cachexia Sarcopenia Muscle* 2015;6:312-314.
67. Morley JE, Little MO, Berg-Weger M. Rapid geriatric assessment: A tool for primary care physicians. *J Am Med Dir Assoc* 2017;18:195-199.
68. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: Evidence for a phenotype. *J Gerontol A Biol Sci Med Sci* 2001;56:M146-M156.
69. Morley JE. Frailty screening comes of age. *J Nutr Health Aging* 2014;18(5):453-454.
70. Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. *Lancet* 2013;281:752-762.
71. Morley JE, Vellas B, van Kan GA, et al. Frailty consensus: A call to action. *J Am Med Dir Assoc* 2013;14(6):392-397.
72. Ng TP, Feng L, Nyunt MS, Feng L, Niti M, Tan BY, et al. Nutritional, physical, cognitive, and combination interventions and frailty reversal among older adults: A randomized controlled trial. *Am J Med* 2015;128:1225-1236.e1.
73. Singh NA, Quine S, Clemson LM, Williams EJ, Williamson DA, Stavrinou TM, et al. Effects of high-intensity progressive resistance training and targeted multidisciplinary treatment of frailty on mortality and nursing home admissions after hip fracture: A

- randomized controlled trial. *J Am Med Dir Assoc* 2012;13:24-30.
74. Tarazona-Santabalbina FJ, Gomez-Cabrera MC, Perez-Ros P, Martinez-Arnau FM, Cabo H, Tsaparas K, et al. A multicomponent exercise intervention that reverses frailty and improves cognition, emotion, and social networking in the community-dwelling frail elderly: A randomized clinical trial. *J Am Med Dir Assoc* 2016;17:426-433.
75. Abizanda P, Lopez MD, Garcia VP, Estrella Jde D, da Silva Gonzalez A, Vilardell NB, Torres KA. Effects of an oral nutritional supplementation plus physical exercise intervention on the physical function nutritional status, and quality of life in frail institutionalized older adults: The ACTIVNES study. *J Am Med Dir Assoc* 2015;16:439.e9-439.e16.
76. Gleason LJ, Benton EA, Alvarez-Nebreda ML, Weaver MJ, Harris MB, Javedan H. FRAIL questionnaire screening tool and short-term outcomes in geriatric fracture patients. *J Am Med Dir Assoc* Aug 2017;30 doi: 10.1016/j.jamda.2017.07.005 [Epub ahead of print].
77. Chong E, Ho E, Baldevarona-Llego J, Chan M, Wu L, Tay L. Frailty and risk of adverse outcomes in hospitalized older adults: A comparison of different frailty measures. *J Am Med Dir Assoc* 2017;18:638.e7-638.e11.
78. Van Kan GA, Rolland Y, Bergman H, et al. The IANA task force on frailty assessment of older people in clinical practice. *J Nutr Health Aging* 2008;12(1):29-37.
79. Morley JE, Malmstrom TK, Miller DK. A simple frailty questionnaire (FRAIL) predicts outcomes in middle aged African Americans. *J Nutr Health & Aging* 2012;16:601-608.
80. Woo J, Yu R, Wong M, et al. Frailty screening in the community using the FRAIL scale. *J Am Med Dir Assoc* 2015;16:412-419.
81. Gleason LJ, Benton EA, Alvarez-Nebreda ML, et al. FRAIL questionnaire screening tool and short-term outcomes in geriatric fracture patients. *J Am Med Dir Assoc* 2017;18:____ (Dec).
82. Malmstrom TK, Miller DK, Morley JE. A comparison of four frailty models. *J Am Geriatr Soc* 2014;62:721-726.
83. Dent E, Lien C, Lim WS, et al. The Asia-Pacific Clinical Practice Guidelines for the management of frailty. *J Am Med Dir Assoc* 2017;18(7):564-575.
84. Leon-Munoz LM, Guallar-Castillon P, Lopez-Garcia E, Rodriguez-Artalejo F. Mediterranean diet and risk of frailty in community-dwelling older adults. *J Am Med Dir Assoc* 2014;15:899-903.
85. Bonnefoy M, Berrut G, Lesourd B, Ferry M, Gilbert T, Guerin O, et al. Frailty and nutrition: Searching for evidence. *J Nutr Health Aging* 2015;19:250-257.
86. Urpi-Sarda M, Andres-Lacueva C, Rabassa M, Ruggiero C, Zamora-Ros R, Bandinelli S, et al. The relationship between urinary total polyphenols and the Frailty Phenotype in a community-dwelling older population: The INCHIANTI study. *J Gerontol A Biol Sci Med Sci* 2015;70:1141-1147.
87. Veronese N, Stubbs B, Noale M, Solmi M, Rizzoli R, Vaona A, et al. Adherence to a Mediterranean diet is associated with lower incidence of frailty: A longitudinal cohort study. *Clin Nutr Sep* 2017;4 doi:10.1016/j.clnu.2017.08.028 [Epub ahead of print].
88. Fielding RA, Vellas B, Evans WJ, et al. Sarcopenia: An undiagnosed condition in older adults. Current consensus definition: Prevalence, etiology, and consequences. International Working Group on Sarcopenia. *J Am Med Dir Assoc* 2011;12(4):249-256.
89. Morley JE, Abbatecola AM, Argiles JM, et al. Society on Sarcopenia, Cachexia and Wasting Disorders Trialist Workshop. Sarcopenia and limited mobility: An international consensus. *J Am Med Dir Assoc* 2011;12(6):403-409.
90. Chen LK, Liu LK, Woo J, et al. Sarcopenia in Asia: Consensus report of the Asian Working Group for Sarcopenia. *J Am Med Dir Assoc* 2014;15:95-101.
91. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, et al. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. *Age Ageing* 2010;39:412-423.
92. Cruz-Jentoft AJ, Landi F, Schneider SM, Zuniga C, Arai H, Boirie Y, et al. Prevalence of an interventions for sarcopenia in ageing adults: A systematic review. Report of the International Sarcopenia Initiative (EWGSOP and IWGS). *Age Ageing* 2014;43:748-759.
93. Vellas B, Fielding R, Bhasin S, Cerrera F, Goodpaster B, Guralnik JM, et al. Sarcopenia trials in specific diseases: Report by the International Conference on Frailty and Sarcopenia Research task Force. *J Frailty Aging* 2016;5:194-200.
94. Weisgarber KD, Candow DG, Farthing JP. Whey protein and high-volume resistance training in postmenopausal women. *J Nutr Health Aging* 2015;19:511-517.
95. Rolland Y, Czerwinski S, van Kan GA, et al. Sarcopenia: Its assessment, etiology, pathogenesis, consequences and future perspectives. *J Nutr Health Aging* 2008;12(7):433-450.
96. Morley JE. Sarcopenia: Diagnosis and treatment. *J Nutr Health Aging* 2008;12(7):452-456.
97. Tieland M, Dirks ML, van der Zwaluw N, Verdijk LB, van de Rest O, de Groot LC, van Loon LJ. Protein supplementation increases muscle mass gain during prolonged resistance-type exercise training in frail elderly people: A randomized, double-blind, placebo-controlled trial. *J Am Med Dir Assoc* 2012;13:713-719.
98. Churchward-Venne TA, Tieland M, Verdijk LB, et al. There are no nonresponders to resistance-type exercise training in older men and women. *J Am Med Dir Assoc* 2015;16:400-411.
99. Bauer J, Biolo G, Cederholm T, et al. Evidence-based recommendations for optimal dietary protein intake in older people: A position paper from the PROT-AGE study group. *J Am Med Dir Assoc* 2013;14:542-559.
100. Bauer JM, Verlaan S, Bautmans I, et al. Effects of a vitamin D and leucine-enriched whey protein nutritional supplement on measures of sarcopenia in older adults, the PROVIDE study: A randomized, double-blind, placebo-controlled trial. *J Am Med Dir Assoc* 2015;16:740-747.
101. Morley JE, Argiles JM, Evans WJ, et al. Nutritional recommendations for the management of sarcopenia. *J Am Med Dir Assoc* 2010;11:391-396.
102. Holecek M. Beta-hydroxy-beta-methylbutyrate supplementation and skeletal muscle in healthy and muscle-wasting conditions. *J Cachexia Sarcopenia Muscle* 2017;8:529-541.
103. Argiles JM, Campos N, Lopez-Pedrosa JM, Rueda R, Rodriguez-Mañas L. Skeletal muscle regulates metabolism via interorgan crosstalk: Roles in health and disease. *J Am Med Dir Assoc* 2016;17:789-796.
104. Woo J, Leung J, Morley JE. Validating the SARC-F: A suitable community screening tool for sarcopenia? *J Am Med Dir Assoc* 2014;15:630-634.
105. Rolland Y, Dupuy C, Abellan van Kan G, et al. Sarcopenia screened by the SARC-F questionnaire and physical performances of elderly women: A cross-sectional study. *J Am Med Dir Assoc* 2017;Jun 16 doi:10.1016/j.jamda.2017.05.010 [Epub ahead of print].
106. Tanaka S, Kamiya K, Hamazaki N, et al. Utility of SARC-F for assessing physical function in elderly patients with cardiovascular disease. *J Am Med Dir Assoc* 2017;18:176-181.
107. Malmstrom TK, Miller DK, Simonsick EM, et al. SARC-F: A symptom score to predict persons with sarcopenia at risk for poor functional outcomes. *J Cachexia Sarcopenia Muscle* 2016;7:28-36.
108. Landi F, Liperoti R, Lattanzio F, Russo A, Tosato M, Barillaro C, et al. Effects of anorexia on mortality among older adults receiving home care: An observation study. *J Nutr Health Aging* 2012;16:79-83.
109. Morley JE. Anorexia of aging: A true geriatric syndrome. *J Nutr Health Aging* 2012;16:422-425.
110. Van Wissen J, van Stijn MF, Doodeman HJ, Houdijk AP. Mini nutritional assessment and mortality after hip fracture surgery in the elderly. *J Nutr Health Aging* 2016;20:964-968.
111. Kelolett J, Kyle G, Itsiopoulos C, Naunton M. Nutrition screening practices amongst Australian residential aged care facilities. *J Nutr Health Aging* 2016;20:1040-1044.
112. Giugoz Y. The mini nutritional assessment (MNA (R)) review of the literature – what does it tell us? *J Nutr Health Aging* 2006;10(6):466-485.
113. Kaiser MJ, Bauer JM, Ramsch C, et al. Validation of the Mini Nutritional Assessment short-form (MNA (R)-SF): A practical tool for identification of nutritional status. *J Nutr Health Aging* 2009;13(9):782-788.
114. Lera L, Sancez H, Angel B, Albalá C. Mini nutritional assessment short-form: Validation in five Latin American cities. SAE study. *J Nutr Health Aging* 2016;20:797-805.
115. Vellas B, Villars H, Abellani G, et al. Overview of the MNA (R) – its history and challenges. *J Nutr Health Aging* 2006;10(6):456-463.
116. Volkert D, Saeglitz C, Gueldenzoph H, et al. Undiagnosed malnutrition and nutrition-related problems in geriatric patients. 2010;14(5):387-392.
117. Miller SL, Wolfe RR. The danger of weight loss in the elderly. *J Nutr Health Aging* 2008;12(7):487-491.
118. Martin A, Ruiz E, Sanz A, Garcia JM, Gomez-Candela C, Burgos R, et al. Accuracy of different mini nutritional assessment reduced forms to evaluate the nutritional status of elderly hospitalized diabetic patients. *J Nutr Health Aging* 2016;20:370-375.
119. Wilson MM, Thomas DR, Rubenstein LZ, Chibnall JT, Anderson S, Baxi A, et al. Appetite assessment: Simple appetite questionnaire predicts weight loss in community-dwelling adults and nursing home residents. *Am J Clin Nutr* 2005;82:1074-1081.
120. Nakatsu N, Sawa R, Misu S, Ueda Y, Ono R. Reliability and validity of the Japanese version of the simplified nutritional appetite questionnaire in community-dwelling older adults. *Geriatr Gerontol Int* 2015;15:1264-1269.
121. Rolland Y, Perrin A, Gardette V, Filhol N, Vellas B. Screening older people at risk of malnutrition or malnourished using the Simplified Nutritional Appetite Questionnaire (SNAQ): A comparison with the Mini-Nutritional Assessment (MNA) tool. *J Am Med Dir Assoc* 2012;13:31-34.
122. Pilgrim AL, Baylis D, Jameson KA, Cooper C, Sayer AA, Robinson SM, Roberts HC. Measuring appetite with the Simplified Nutritional Appetite Questionnaire identifies hospitalised older people at risk of worse health outcomes. *J Nutr Health Aging* 2016;20:3-7.
123. Morley JE. Weight loss in older persons: New therapeutic approaches. *Curr Pharm Des* 2007;13:3637-3647.
124. Ezeoke CC, Morley JE. Pathophysiology of anorexia in the cancer cachexia syndrome. *J Cachexia Sarcopenia Muscle* 2015;6:287-302.
125. Morley JE. Anorexia of Ageing: A key component in the pathogenesis of both sarcopenia and cachexia. *J Cachexia Sarcopenia Muscle* 2017;8:523-526.
126. Nakayama M, Tabuchi K, Hara A. Clinical utility of the modified Glasgow prognostic score in patients with advanced head and neck cancer. *Head Neck* 2015;37:1745-1749.

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127. Anker SD, Coats AJ, Morley JE. Evidence for partial pharmaceutical reversal of the cancer anorexia-cachexia syndrome: The case of anamorelin. *J Cachexia Sarcopenia Muscle* 2015;6:275-277.
128. Cholerton B, Larson EB, Baker LD, Craft S, Crane PK, Millard SP, et al. Neuropathologic correlates of cognition in a population-based sample. *J Alzheimers Dis* 2013;36:699-709.
129. Morley JE. Mild cognitive impairment—a treatable condition. *J Am Med Dir Assoc* 2014;15(1):1-5.
130. Martinez-Lapiscina EH, Clavero P, Toledo E, et al. Virgin olive oil supplementation and long-term cognition: The Predimed-Navarra randomized, trial. *J Nutr Health Aging* 2013;17(6):544-552.
131. Farr SA, Price TO, Dominguez LJ, Motisi A, Saiano F, Niehoff ML, et al. Extra virgin olive oil improves learning and memory in SAMP8 mice. *J Alzheimers Dis* 2012;28:81-92.
132. Solfrizzi V, Custodero C, Lozupone M, Imbimbo BP, Valiani V, Agosti P, et al. Relationships of dietary patterns, foods, and micro- and macronutrients with Alzheimer's disease and late-life cognitive disorders: A systematic review. *J Alzheimers Dis* 2017;59:815-849.
133. Salva A, Andrieu S, Fernandez E, Schiffrin EJ, Moulin J, Decarli B, et al. Health and nutrition promotion program for patients with dementia (NutriAlz): Cluster randomized trial. *J Nutr Health Aging* 2011;15:822-830.
134. Shah R. The role of nutrition and diet in Alzheimer disease: A systematic review. *J Am Med Dir Assoc* 2013;14:398-402.
135. Bourre JM. Dietary omega-3 fatty acids and psychiatry: Mood, behavior, stress, depression, dementia and aging. *J Nutr Health Aging* 2005;9(1):31-38.
136. Ferry M, Coley N, Andrieu S, Bonhomme C, Caubere JP, Cesari M, et al. How to design nutrition intervention trials to slow cognitive decline in apparently healthy populations and apply for efficacy claims: A statement from the International Academy on Nutrition and Aging Task Force. *J Nutr Health Aging* 2013;17:619-623.
137. Langa KM, Larson EB, Crimmins EM, Faul JD, Levine DA, Kabeto MU, Weir DR. A comparison of the prevalence of dementia in the United States in 2000 and 2012. *JAMA Intern Med* 2017;177:51-58.
138. Morley JE, Farr SA, Kumar VB, Armbricht HJ. The SAMP8 mouse: A model to develop therapeutic interventions for Alzheimer's disease. *Curr Pharm Des* 2012;18:1123-1130.
139. Morley JE, Armbricht HJ, Farr SA, Kumar VB. The senescence accelerated mouse (SAMP8) as a model for oxidative stress and Alzheimer's disease. *Biochim Biophys Acta* 2012;1822:650-656.
140. Morley JE. Diabetes: The diabetic brain. *Nat Rev Endocrinol* 2017;13:570-571.
141. Malmstrom TK, Voss VB, Cruz-Oliver DM, Cummings-Vaughn LA, Tumosa N, Grossberg GT, Morley JE. The rapid cognitive screen (RCS): A point-of-care screening for dementia and mild cognitive impairment. *J Nutr Health Aging* 2015;19:741-744.
142. Berg-Weger M, Tebb S, Henderson-Kalb J, Zubatsky M, Lundy J, Hayden D. Cognitive stimulation therapy: A tool for your practice with persons with dementia? *J Am Med Dir Assoc* 2015;16:795-796.
143. D'Amico F, Rehill A, Knapp M, Aguirre E, Donovan H, Hoare Z, et al. Maintenance cognitive stimulation therapy: An economic evaluation within a randomized controlled trial. *J Am Med Dir Assoc* 2015;16:63-70.
144. Loraine J, Taylor S, McAllister M. Cognitive and physical stimulation therapy. *J Am Med Dir Assoc* 2014;15:140-141.
145. Morley JE, Cruz-Oliver DM. Cognitive stimulation therapy. *J Am Med Dir Assoc* 2014;15:689-691.
146. Rippolo M, Mulasso A, Rabaglietti E. Cognitive frailty in Italian community-dwelling older adults: Prevalence rate and its association with disability. *J Nutr Health Aging* 2017;21:631-636.
147. Sargent L, Brown R. Assessing the current state of cognitive frailty: Measurement properties. *J Nutr Health Aging* 2017;21:152-160.
148. Shimada H, Makizako H, Lee S, Doi T, Lee S, Tsutsumimoto K, et al. Impact of cognitive frailty on daily activities in older persons. *J Nutr Health Aging* 2016;20:729-735.
149. Tay L, Lim WS, Chan M, Ye RJ, Chong MS. The independent role of inflammation in physical frailty among older adults with mild cognitive impairment and mild-to-moderate Alzheimer's disease. *J Nutr Health Aging* 2016;20:288-299.
150. Halil M, Cemal Kizilarlanoglu M, Emin Kuyumcu M, Yesil Y, Cruz-Jentoft AJ. Cognitive aspects of frailty: Mechanisms behind the link between frailty and cognitive impairment. *J Nutr Health Aging* 2015;19:276-283.
151. Canevelli M, Cesari M. Cognitive frailty: What is still missing? *J Nutr Health Aging* 2015;19:273-275.
152. Kalaiditi E, Cesari M, Canevelli M, et al. (2013) Cognitive frailty: Rational and definition from an (IANA/IAGG) International consensus group. *J Nutr Health Aging* 2013;17(9):726-734.
153. Rolland Y, Tolson D, Morley JE, Vellas B. The International Association of Gerontology and Geriatrics (IAGG) nursing home initiative. *J Am Med Dir Assoc* 2014;15:307-308.
154. Tolson D, Rolland Y, Andrieu S, et al. The International Association of Gerontology and Geriatrics: A global agenda for clinical research and quality of care in nursing homes. *J Am Med Dir Assoc* 2011;12:184-189.
155. Morley JE, Caplan G, Cesari M, et al. International survey of nursing home research priorities. *J Am Med Dir Assoc* 2014;15:309-312.
156. Kaehr EW, Pape LC, Malmstrom TK, Morley JE. FRAIL-NH predicts outcomes in long term care. *J Nutr Health Aging* 2016;20:192-198.
157. Laffon de Mazieres C, Morley JE, Levy C, et al. Prevention of functional decline by reframing the role of nursing homes? *J Am Med Dir Assoc* 2017;18(2):105-110.
158. de Souto Barreto P, Vellas B, Morley JE, et al. The nursing home population: An opportunity to make advances on research on multimorbidity and polypharmacy. *J Nutr Health Aging* 2013;17(4):399-400.
159. Morley JE. Geriatricians: The super specialists. *J Am Geriatr Soc* 2017;65(4):866-868.