should be carefully considered by health professionals, and pharmacological alternatives to Z-drugs must be highlighted. For example, melatonin and Z-drugs, which have few residual side-effects, could be considered as an alternative to benzodiazepines for treating insomnia.

Health service staff do not generally have specific training in sleep medicine, but even some basic training about the link between sleep and falls might help to decrease this concern. Professionals could learn how to carry out general assessments of sleep quality that would enable them to refer their patients to specialized care when necessary. Health professionals need more information about sleep stages and the perception of older people in relation to their sleep. A multidisciplinary team trained to identify sleep disorders would help to improve even other comorbid illnesses that sleep has a bidirectional relationship with. The assessment can be carried out using the gold standard that is polysomnography, which is a highly capable instrument to identify sleep disorders or actigraphy, which is another objective and validated way to diagnose sleep complaints. A low-cost strategy is questionnaires, which could be widely used in clinical practice, such as the Pittsburgh Sleep Quality Index, Insomnia Severity Index and Berlin Apnea Questionnaire, among others. Sleep organizations in partnership with local health entities can offer courses on sleep medicine to health professionals. If outcomes show the possible presence of a sleep disorder, patients should be referred to a sleep specialist.

In conclusion, evaluating the sleep of older patients might help to reduce their risk of falling, and consequently prevent several serious health-threatening conditions. Reducing fall risk in older adults through sleep assessment could potentially improve mortality and quality of life, prevent disability, and reduce healthcare costs.

Acknowledgements

Our studies are supported by grants from the Associação Fundo de Incentivo à Pesquisa (AFIP). MLA and ST are Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) fellowship recipients.

Disclosure statement

The authors declare no conflict of interest.

Data Availability Statement

Not applicable.

References

1. Florence CS, Bergen G, Athley A, Burns E, Stevens J, Drake C. Medical costs of fatal and nonfatal falls in older adults. *J Am Geriatr Soc* 2018; 66: 693–698.
2. Davis JC, Robertson MC, Aste MC, Liu-Ambrose T, Khan KM, Marra CA. International comparison of cost of falls in older adults living in the community: a systematic review. *Osteoporos Int* 2010; 21: 1295–1306.
3. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the global burden of disease study 2019. *Lancet*. 2020; 396: 1204–1222.
4. Min Y, Stattum PW. Poor sleep and risk of falls in community-dwelling older adults: a systematic review. *Appl Gerontol* 2018; 37: 1059–1084.
5. Patel D, Steinberg J, Patel P. Insomnia in the elderly: a review. *J Clin Sleep Med* 2018; 14: 1017–1024.
6. Nakakubo S, Doi T, Shimada H et al. The association between excessive daytime sleepiness and gait parameters in community-dwelling older adults: cross-sectional findings from the Obu study of health promotion for the elderly. *J Aging Health*. 2018; 30: 213–228.
7. Marron L, Segurado R, Kenny RA, McNicholas T. The association between excessive daytime sleepiness and gait parameters in community-dwelling older adults: cross-sectional findings from the Obu study of health promotion for the elderly. *J Aging Health*. 2018; 30: 213–228.
8. Morelhão PK, Gobbi C, Galduróz JCF, Tufik S, Andersen ML. Zolpidem for older adults: to prescribe or not to prescribe? *Int J Geriatr Psychiatry*. 2020; 35: 689–690.
9. Xie Z, Chen F, Li WA et al. A review of sleep disorders and melatonin. *Neural Regen* 2017; 39: 559–565.
10. Morelhão PK, Kim LJ, Pinto RZ, Tufik S, Andersen ML. Should physical therapists assess sleep quality in patients seeking care for low back pain? *Phys Ther*. 2019; 99: 961–963.

Antibody response to BNT162b2 mRNA vaccine in healthcare workers and residents in a long-term care facility

Dear Editor,

Starting on 12 April 2021, Japan began administering coronavirus disease 2019 vaccines to senior citizens aged ≥65 years. As of September 2021, >80% of them already completed two doses of vaccination. As a result, the new cases of infections among older adults have decreased and the incident of clusters in long-term care facilities (LTCFs) have dramatically reduced. Coronavirus disease 2019 vaccine booster shots are considered in Japan at this point due to the waning immunity. To determine who should receive the booster shot, it is necessary to investigate the antibody response by the different age group and situation.

Viviane A Kakazu, Priscila K Morelhão, Vinicius Dokkedal-Silva, Sergio Tufik and Monica L Andersen

1Physical Therapy Department, Sao Paulo State University (UNESP), Presidente Prudente, Brazil
2Psychobiology Department, Federal University of São Paulo (UNIFESP), São Paulo, Brazil

How to cite this article: Kakazu VA, Morelhão PK, Dokkedal-Silva V, Tufik S, Andersen ML. Increasing health professional awareness about the link between sleep and falls in older adults. Geriatr. Gerontol. Int. 2022;22:178–179. https://doi.org/10.1111/ggi.14338

© 2022 The Authors. *Geriatrics & Gerontology International* published by John Wiley & Sons Australia, Ltd on behalf of Japan Geriatrics Society. This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.
We compared the serological response induced by two doses of the mRNA vaccine, BNT162b2, between LTCF residents and healthcare workers (HCWs).

Written informed consent was obtained from all participants. If residents lacked the capacity to consent, the responsible guardian’s permission was obtained. This study was approved by Health Sciences University of Hokkaido Research Ethics Boards (20N037045). A total of 75 residents of a LTCF and 69 HCWs of the LTCF and the affiliated hospital were included in the present study. Those previously infected with SARS-Cov-2 were excluded from this study. Almost all residents had more than two comorbidities and required assistance for activities of daily living. Four groups were compared: group 1: HCWs aged ≤64 years; group 2: HCWs aged between 65 and 84 years; group 3: LTCF residents aged between 65 and 84 years; and group 4: LTCF residents aged ≥85 years. Blood samples were collected at 28–45 days after the second injection using the BNT162b2 mRNA vaccine.

The quantitative enzyme-linked immunosorbent assay test to measure an anti-SARS-Cov-2 immunoglobulin G antibody to S1 protein was carried out by using the Vitros Immunodiagnostic Product anti-SARS-Cov-2 S1 Quant immunoglobulin G test (Ortho Clinical Diagnostics, Raritan, NJ, USA) according to the manufacturer’s instructions. Results were expressed as binding activity units per mL (BAU/mL; positive threshold: 17.8 BAU/mL; upper limit: 4000 BAU/mL).

For comparative analysis of antibody levels between four groups, the Kruskal–Wallis test followed by the Mann–Whitney U-test, using the Bonferroni correction with adjustment of the probability (P < 0.05 / 4 = 0.0125) was carried out.

After vaccination, all residents tested positive for antibodies, except two residents. However, the median antibody titers were eightfold and fivefold lower in group 3 (median antibody titer 127 BAU/mL) and group 4 (median antibody titer: 200 BAU/mL), respectively, compared with those of group 1 (median antibody titer 1095 BAU/mL; P = 7.25465E-08 and 1.11602E-14, respectively; Fig. 1). Compared with the median antibody titers of group 1, those of group 2 tended to be lower, but the difference was not significant (P = 0.26341; Fig. 1). However, the median antibody titers of group 2 were higher than those of group 3 (P = 0.000415; Fig. 1).

The present study found that serological response to two doses of the mRNA vaccine, BNT162b2, in LTCF residents was significantly lower than those in HCWs aged between 65 and 84 years, as well as in HCWs aged <64 years. This finding is in accordance with previous studies that compared the response to the vaccination in LTCFs and HCWs.1,2 In addition, the present study showed that the serological response of older HCWs did not show any significant difference compared with that of younger HCWs, in accordance with previous studies that examined the response to the vaccination among older adults.3,4 These results suggest that LTCF residents are thought to be immunocompromised by a variety of factors in addition to aging, such as comorbidity, malnutrition and inactivity,5 and that LTCF residents should be included in the target population for the third booster vaccine. Limitations include the small sample size, possible selection bias, failure to identify factors other than aging and failure to investigate cellular immunity.
How many food items must be consumed to meet the recommended dietary protein intake for older Japanese adults?

Dear Editor,

In humans, muscle mass and strength begin to decline after the age of 30.1 We previously reported a dose-response relationship between protein intake and muscle mass through a systematic review and meta-analysis that examined the effects of protein intake on lean body mass.2 The Dietary Reference Intake for Japanese (2020) set the recommended dietary allowance (RDA) for protein intake, aged ≥65 years at 60 g/day for males and 50 g/day for females. The 2012 National Health and Nutrition Survey in Japan (NHNS-J) reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3 As you reported that approximately 20% of middle-aged and older adults had a protein intake of less than 1.0 g/kg body weight/day.3

We used data pertaining to 143 older adults (78 males and 65 females) aged 65–88 years who participated in the Kyoto–Kameoka Study in Japan and kept a dietary record (DR) for seven consecutive days, from May to June 2012.5 The research staff taught the participants how to keep a DR using a record sheet that was completed at the orientation session. The registered dietitians instructed the participants to keep a record of all the food and beverages that they consumed. We provided each participant with a blank DR sheet, a digital scale (TANITA, Tokyo, Japan), and educational handouts to record food intake. The number of food items was calculated based on the number of foods consumed from 18 food groups. Included in the count were cereals, potatoes and starches, pulses, nuts and seeds, vegetables, fruits, mushrooms, algae, fish, mollusks and crustaceans, meat, eggs, milk and milk products, and fats and oils. Excluded in the count were sugars and sweeteners, confectionaries, beverages, seasonings and spices, and prepared foods. These were the same criteria as followed in the NHNS-J 2013.7

We calculated the number of food items needed to meet the RDA for protein intake, aged ≥65 years, as follows: 73.6 (12.7) g/day, and 23.1 (7.3) items, respectively. Based on the seven-day DRs (1001 days of data), the proportion of males and females who did not meet the RDA for protein intake was 18.1% and 13.4%, respectively. To determine the number of food items needed to meet the RDA for protein intake, we calculated the area under the receiver operating characteristic curves, which was 0.738 (95% CI: 0.686–0.789) for males and 0.702 (95% CI: 0.631–0.774) for females (Fig. 1a, b). The cut-off number of food items required to meet the RDA for protein intake was 20 for both males and females. Multivariate adaptive regression splines analysis showed that increasing the number of food items by one was associated with better physical performance in older Japanese adults aged ≥65 years.

The authors declare no conflict of interest.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgements

This work was supported, in part, by the Grant from Advanced Research Promotion Center, Health Sciences University of Hokkaido. We thank Ortho Clinical Diagnostics to lend us Vitros XT7600 integrated system. We thank Yoko Tsukamoto, PhD, School of Nursing & Social Services, Health Sciences University of Hokkaido, for support in drafting of the manuscript. LCDR Thompson did not receive any compensation.

Disclosure statement

The authors declare no conflict of interest.

References

1 van Praet JT, Vandecasteele S, de Roo A et al. Humoral and cellular immunogenicity of the BNT162b2 mRNA Covid-19 vaccine in nursing home residents. Clin Infect Dis 2021; 73: ciaa300. https://doi.org/10.1093/cid/ciaa300.
2 Seyahi E, Bakhdjyari G, Oztas M et al. Antibody response to inactivated COVID-19 vaccine (CoronaVac) in immune-mediated diseases: a controlled study among hospital workers and elderly. Rheumatol Int 2021; 41: 1429–1440.
3 Anderson EJ, Rouphael NG, Widge AT et al. Safety and immunogenicity of SARS-CoV-2 mRNA-1273 vaccine in older adults. N Engl J Med 2020; 383: 2427–2438. https://doi.org/10.1056/NEJMoa2028436.
4 Parry H, Bruton R, Stephens C et al. Differential immunogenicity of BNT162b2 or ChAdOx1 vaccines after extended-interval homologous dual vaccination in older people. Immun Ageing 2021; 18: 34. https://doi.org/10.1186/s12979-021-00246-9.
5 Pulop T, Pawelec G, Castle S, Loeb M. Immunosenescence and vaccination in nursing home residents. Clin Infect Dis 2009; 48: 443–448. https://doi.org/10.1086/596475.

How to cite this article: Kitagawa T, Kuramitsu Y, Nakagawa K, et al. Antibody response to BNT162b2 mRNA vaccine in healthcare workers and residents in a long-term care facility. Geriatr. Gerontol. Int. 2022;22:179–181. https://doi.org/10.1111/ggi.14342