

論文内容要旨

Bayesian analysis of the association between effective strategies of multimodal nonpharmacological intervention and characteristics of cognitive function in nursing home residents with cognitive impairment A cross-sectional study

(ベイズ統計を用いたマルチモーダル非薬物的介入の効果的な戦略と施設入所認知障害高齢者における認知機能の特徴との関連の検討
: 横断研究)

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Abstract

Introduction: Many people with cognitive impairment (CI) are eventually admitted to a nursing home (NH), and it has been reported that cognitive function tends to decline in NH residents with CI. Therefore, the further development of non-pharmacological interventions (NPIs), which are expected to have the same beneficial effects as pharmacological interventions, is required. In recent years, it is necessary to develop an effective multimodal non-pharmacological intervention (MNPI) strategy to improve the cognitive function of NH residents with CI. Our previous systematic review found that an MNPI strategy combining exercise, cognitive interventions, and practice carrying out activities of daily living (ADL) may be effective for improving global and specific cognitive function in NH residents with CI. In recent years, Bayesian analyses have attracted increased attention as an intuitive and easy to interpret statistical method that enables stable estimation even for complex models.

Objective: The objective of this study was to clarify the associations between NPIs constituting a MNPI strategy and the global and specific cognitive function characteristics of NH residents with CI based on predictions from Bayesian analysis, which could aid in the development of more effective MNPI strategies.

Methods: This cross-sectional design study enrolled 61 residents (90.16% female; mean age \pm standard deviation [SD]: 87.20 \pm 6.90 years) of five NHs. Analyses were performed using a hierarchical Bayesian model in which individual and group differences were incorporated as random effects for intercepts, and the global and specific cognitive functions, as assessed by the Japanese version of the Neurobehavioral Cognitive Status Examination (COGNISTAT), were used as the response variables. Three types of NPIs (cognitive enhancement, physical, and psychological and psychosocial) and ADL as assessed by the Barthel Index (BI) were used as the explanatory variables (the BI as assessed by NH staff was substituted as an indirect index of ADL). Parameters were estimated using the Bayesian Markov chain Monte Carlo method. The prior distribution used a half-Cauchy distribution. Five Markov chains simulated 25,000 draws and discarded 5000 warm-up draws. The appropriateness of the posterior distribution was assessed when the Rhat statistic was <1.1 . Model selection was based on matching background information, easy to understand, and robust. In addition, the models were verified by assessing a plot representing the observed and predicted values.

Results: In the Bayesian statistical modeling, the posterior distribution was generated as a distribution that approximated a true distribution (Rhat <1.1). The models were also robust. The plots of the observed and predicted values were assessed such that the response variables could be approximately predicted by the explanatory variables. Regarding the types of dementia, 11 NH residents (18.03%) had Alzheimer's disease, none (0%) had vascular dementia, one (1.64%) had mixed dementia, 18 (29.51%) had dementia (no data), and 31 (50.82%) had no diagnosis. As for CDR, 1 scored a 24 (39.34%) and 2 scored a 37 (60.66%).

The mean \pm SD BI was 70.74 ± 16.25 . The mean \pm SD score on the Mini-Mental State Examination-Japanese was 18.18 ± 3.68 . The mean \pm SD standardized total COGNISTAT score was 62.39 ± 13.36 . The mean \pm SD standardized scores for each of the COGNISTAT subtests were as follows: orientation 3.05 ± 2.94 , attention 4.54 ± 3.99 , comprehension 5.74 ± 3.53 , repetition 7.90 ± 2.70 , naming 6.59 ± 2.33 , construction 5.46 ± 1.64 , memory 5.75 ± 1.29 , calculations 6.85 ± 2.54 , similarities 8.13 ± 1.43 , and judgment 8.38 ± 1.55 . No association was found between the cognitive enhancement NPI and any cognitive function. The physical NPI was negatively associated with orientation (OR: 0.31, 95% CI: -2.33, -0.10), comprehension (OR: 0.16, 95% CI: -2.78, -0.95), and naming (OR: 0.49, 95% CI: -1.47, -0.02). The psychological and psychosocial NPI was positively associated with comprehension (OR: 3.67, 95% CI: 0.52, 2.13). The BI was positively associated with total COGNISTAT score (OR: 1.74, 95% CI: 0.08, 2.12), comprehension (OR: 3.49, 95% CI: 0.45, 4.67), repetition (OR: 10.07, 95% CI: 0.53, 9.01), naming (OR: 2.24, 95% CI: 0.07, 3.20), and calculations (OR: 18.82, 95% CI: 2.71, 9.40).

Conclusion: Cognitive enhancement NPIs may allow the difficulty level to be easily adjusted according to cognitive function characteristics, and physical NPIs may be highly useful for NH residents with CI. The psychological and psychosocial NPI in this study may be an NPI that is more easily delivered to subjects with relatively high cognitive function in NH residents with CI. However, it remains necessary to gain a better understanding of how to make it easier for NH residents with lower comprehension skills to participate in psychological and psychosocial NPIs. ADL-enhancing NPIs may need to consider the participation of NH residents with low cognitive function. The implementation of MNPI strategies should therefore be preceded by cognitive enhancement and physical NPIs. Providing ADL-enhancing NPIs in response to cognitive improvement may be an effective strategy. Providing cognitive enhancement, physical, psychological and psychosocial, and ADL-enhancing NPIs concurrently may also be an effective strategy for NH residents with mild dementia who are considered to have relatively high cognitive function. The results of the Bayesian analysis could be updated if new data were to become available. It can be assumed that there is no discomfort in daily experience. This seems to lead to the consideration of effective strategies of MNPI based on probabilities and predictions. In the future, the effects of MNPI strategies on global and specific cognitive functions in NH residents with CI need to be assessed in studies using a longitudinal intervention design.