Clinical Data Analysis and Reporting System in Hong Kong using machine learning. Population-based EMRs from the Clinical Algorithm for Predicting Dementia Diagnosis from Cognitive Footprints in Electronic Medical Records (EMRs) across the lifespan. This study aimed to develop a clinical algorithm for predicting dementia diagnosis from cognitive footprints in EMRs, using a wide range of established and validated algorithms such as logistic regression, Cox regression models, and machine learning models including Multilayer perceptron, Multinomial logistic regression, and LightGBM. We included all patients with dementia diagnosis from the Hong Kong population-based EMR database and matched them (1:1) by age, sex, and index date. We compared the performance of the developed algorithm with five other machine learning models: Multinomial logistic regression, Multilayer perceptron, Multivariate logistic regression, Cox regression models, and LightGBM. The area under the curve (AUC) of the developed algorithm was 0.699, which was comparable to the AUC of 0.720 for the randomly selected test set. The Multilayer perceptron and LightGBM models showed comparable performance with the developed algorithm. The predictive accuracy of dementia improved substantially in the developed algorithm compared to the logistic regression model (area under the curve [AUC]: 0.60). The exploratory risk factors identified at midlife and late-life using individual retrospective, telephone interviews, informant interviews, hospitalization records, and death certificates. The population attributable fraction (PAF) of dementia to non-normal BP value (SBP ≥120 or DBP ≥80) was estimated to be 15-20% of dementia cases by age 80. The strongest PAFs (12-21%) were from stage 2 hypertension. Current estimates of the dementia risk attributable to hypertension is estimated to be low. Targeting hypertension from midlife through early late-life could sizably reduce dementia risk. The cognitive footprint theory suggests that a person’s cognitive performance is influenced by multiple factors across the lifespan, including midlife and late-life hypertension.
Physical activity (PA) is associated with cognitive function and Alzheimer’s disease and related dementias (ADRD). Although associations between continuously measured PA and ADRD have been assessed, multiscale entropy (MSE), which quantifies dynamics of physiological systems over multiple time scales, has not been used to quantify daily activity rhythms in older adults by cognitive status. We examined the association of this novel metric of PA complexity with cognitive function, mild cognitive impairment (MCI), and dementia in participants of the Baltimore Longitudinal Study of Aging. A total of 615 older adults (mean age=73.9±11.3 years, 54.5% women) completed a 7-day wrist-worn accelerometer assessment between 2015-2019. Global cognitive function was measured using the Mini-Mental State Examination (MMSE). Mild cognitive impairment (MCI) or dementia was diagnosed based on Petersen criteria and Diagnostic and Statistical Manual of Mental Disorders, respectively. Unadjusted logistic regression models showed that participants in the lowest tertile of complexity had 2.31 times the odds of low MMSE score (≤26) compared to those in the highest tertile (odds ratio [OR]=2.31, 95% confidence interval [CI]=1.09-4.89). This association lost significance after adjusting for age, sex, race, and education years. The lowest tertile of complexity was also associated with 2.58 times the odds of MCI/dementia diagnosis, adjusting for demographics (OR=2.58, 95% CI=1.06-6.31). These results suggest that lower complexity of accelerometry-detected movement is associated with poorer cognitive function and greater risk of MCI/dementia. Future longitudinal studies are warranted to examine whether altered complexity of daily activity rhythms may act as a preclinical indicator of ADRD.