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Mobile health applications (app) have shown to be beneficial for chronic disease management. However, few studies assessed older adults' engagement in tracking self-management activities with app functions and effectiveness on improving their diabetes outcomes. This study investigated tracking patterns of each app function (blood sugar, blood pressure, diet, exercise, medication adherence etc.) in a graphic-based aging-friendly diabetes self-management app (IMTOP app) and associated the patterns with changes in HbA1c, self-care behavior, diabetes empowerment, and health promotion. The sample included 334 community-dwelling older adults with type 2 diabetes in Taiwan (mean age 64.57 ± 6.64 years) participated in the IMTOP training course that designed to motivate and train older adults with diabetes to use mobile tablets and apps. We performed trajectory analyses using SAS TRAJ procedure to identify distinct classes of individuals following similar longitudinal patterns on absence or presence of weekly app use for each individual app function. The relationships between the app engagement class memberships and 4- and 8-month diabetes health outcomes were assessed using an econometric regression analysis approach. The results showed the degree of app engagement on any single function was significantly and positively correlated with diabetes self-care scale scores (all $p < .05$). Only the engagement on the blood sugar function had statistically significant association with HbA1c improvements ($p < .05$). The app use was not associated with diabetes empowerment or health promotion. The study findings suggest any app function engagement significantly improved older adults' overall self-management but blood sugar tracking is critical to improve HbA1c.

INCREASED PHYSIOLOGICAL VARIABILITY PREDICTS DECLINING HEALTH AND CRITICAL TRANSITIONS IN HEMODIALYSIS PATIENTS

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Increased variability in levels of several individual biomarkers has been shown to predict adverse outcomes, particularly in hemodialysis patients, for whom time series data is often available. Here, we evaluate the feasibility of using multivariate approaches to quantify global physiological variability as a potential predictor of adverse outcomes. We used data on 588 deaths and 1196 hospitalisations across ~38,000 visits of 591 hemodialysis patients at a Quebec hospital, as well as data on frailty and mortality in 580 patients assessed 20+ times within a one-year period at a hospital in Saitama, Japan. We use two approaches: principal components analysis (PCA) of the coefficients of variation (CVs) of the individual biomarkers over the previous year, and Mahalanobis distance (MD) of the biomarker profile relative to the same profile at the previous time point. We show that both methods provide substantial prediction of both impending mortality and impending hospitalisation, with hazard ratios across the 95% quantile range of the indices

varying between 1.5 and 3.5 ($p < 0.0001$). Each unit change on the first PCA axis (PC1) increased frailty odds by 2.34 (95% CI: 1.21-4.52). PCA performed substantially better than MD. CVs of various biomarkers were consistently positively correlated, and PC1 was a good predictor of frailty, mortality, and hospitalisation. Overall, these results confirm that complex physiological integration can break down, resulting in loss of homeostatic control and increasing variability, as predicted by complex systems theory. The resulting indices provide a predictive signal of impending critical health transitions, with both theoretical and clinical implications.

MULTIMORBIDITY PATTERNS ARE DIFFERENTLY ASSOCIATED WITH DEPRESSION IN MIDDLE-AGED AND OLDER CHINESE

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The associations of multiple physical conditions with depression are still unclear. This study examined the relationship between physical multimorbidity patterns and depression among middle-aged and older Chinese. Patterns of physical multimorbidity were identified using Exploratory Factor Analysis (EFA) among 21,933 participants ≥ 45 years from 2011 to 2015. Multiple logistic regressions were performed to assess the associations between multimorbidity, multimorbidity patterns (factor scores) and depression for each age group (45-60 years vs. ≥ 60 years). The overall prevalence of multimorbidity was 40% and it was higher among participants with depression (54%) than those without depression (33%). Middle-aged (OR: 1.45; 95%CI 1.16-1.80) and older (OR: 1.85; 95%CI 1.62-2.11) adults with multimorbidity were more likely to have depression compared with those without multimorbidity. Five multimorbidity patterns were identified: cardio-metabolic, respiratory, splanchnic, cardio-cerebrovascular, and tumor-and-degenerative. Middle-aged participants with higher respiratory pattern score had a higher odds to have depression (OR: 1.59; 95%CI 1.15-2.21). Among older adults, higher cardio-metabolic pattern score was significantly associated with lower odds of depression (OR: 0.78; 95% CI 0.63-0.97), while higher respiratory (OR: 1.32; 95%CI 1.04-1.68), splanchnic (OR: 1.22; 95%CI 1.01-1.47) and tumor-and-degenerative pattern scores (OR: 1.86; 95%CI 1.42-2.43) were all found to be significantly associated with higher risk of depression. The associations between physical multimorbidity patterns and depression differ by age. Future studies are needed to investigate the temporal nature of how physical multimorbidity patterns may induce depression and the underlying mechanisms.

TRANSLATING RESEARCH TO PRACTICE: USING CHANGE MODEL TO IMPROVE SUSTAINABILITY OF HEALTH ALERTS FOR CHRONIC ILLNESS

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Chronic illness is the primary reason for hospitalization and rehospitalization in the US today. Nearly 1/3 of older