From social deprivation to dementia: the mediating role of frailty in ageing-related risk pathways

Background

Social deprivation is associated with greater age-related disease burden and may increase dementia risk, potentially via frailty. We aimed to: (1) characterise how area-level deprivation relates to frailty through individual-level professional, lifestyle and social pathways; and (2) estimate the extent to which frailty arising from those pathways hastens the onset of incident dementia.

Methods

We used data from 188,486 UK Biobank participants aged >60 years, residing in England and free of dementia at baseline. Area-level social deprivation was measured using seven domains from the English Index of Multiple Deprivation, and proximity to greenspace. Frailty was quantified using a validated 49-item frailty index. Using data from questionnaires completed at baseline, latent variables were specified for professional opportunities, lifestyle behaviours and social functioning, and validated with confirmatory factor analysis. We fitted a structural equation model (SEM) with social deprivation predicting the latent domains and frailty. Finally, we derived SEM-predicted frailty scores, categorised them into low, intermediate and high tertiles, and estimated the relationship between those frailty groups and incident all-cause dementia using an accelerated failure time model adjusted for sex.

Results

Over 2,417,259 person-years of follow-up, 7,250 participants (3.8%) developed dementia. The SEM showed adequate global fit (CFI 0.94, TLI 0.92, RMSEA 0.052). Higher social deprivation was associated with fewer professional opportunities ($\beta = -0.46$) and healthy lifestyle behaviours ($\beta = -0.33$), poorer social functioning ($\beta = -0.30$) and with higher frailty scores directly ($\beta = 0.05$). Worse social functioning ($\beta = -0.41$), and to a lesser extent fewer lifestyle behaviours ($\beta = -0.07$) and professional opportunities ($\beta = -0.02$), were associated with higher frailty. Compared with participants with low predicted frailty scores, those with medium and high predicted frailty scores had earlier dementia diagnoses (time ratios [TRs] 0.98, 95% CI 0.98–0.99; TR 0.96, 95% CI 0.96–0.97, respectively), corresponding to dementia being diagnosed ≈1.6 and 3.5 years earlier, on average.

Conclusions

In this large cohort, area-level social deprivation was associated with higher frailty, both directly and via professional, social and lifestyle pathways. Higher SEM-predicted frailty was linked to earlier dementia onset, supporting the importance of life-course, population-level dementia prevention strategies that target the social and structural determinants of frailty.