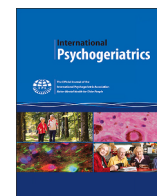




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Predictors of unhealthy aging

This Special Section of International Psychogeriatrics contains five papers relating to unhealthy aging. Four are epidemiological and seek to identify factors that predict poor health, frailty, mortality and loneliness. The fifth describes the initial stages of the development of an intervention to target loneliness. Collectively, then, and in a broad sense, they represent two parts of the pathway towards tackling poor health outcomes in later life.

Early life factors are known to affect health outcomes in later life, but the relationship is complex with many possible mediators that accumulate over the life span. To try to unpick some of this complexity, Liu et al. used the nationally representative China Health and Retirement Longitudinal Study (CHRLS) study to examine whether the relationship between adverse childhood experiences (ACEs) and self-rated health was mediated by activities of daily living (ADL) and chronic diseases [1]. The data show a life-long impact of ACEs on self-rated health, underscoring the importance of a stable and supportive early life in maintaining good health into older age. The sample characteristics are a major strength of this study as they include a high proportion of participants with lower educational levels, a group often not represented in similar studies. The relationship between ACEs and health was mediated by chronic disease and ADLs, however, the statistical model did not account for bidirectional relationships between chronic diseases, ADLs and the self-rated health outcome, which could limit the insights gained from this study. Another key limitation, acknowledged by the authors, is the possibility of recall bias for ACEs. While important to highlight, it is noteworthy that the likely the more specific problem is false-negative responses [2].

Another risk factor that can be life-long or stable over many years is socioeconomic status (SES). Yan et al. examined the relationship between SES (low, medium and high) and incident frailty in two independent cohorts (English Longitudinal Study of Ageing, UK; and Health and Retirement Study, USA) [3]. In Cox proportional hazards models, low SES was associated with incident frailty. This could suggest targeting SES in interventions for frailty, but one practical problem is that this requires action across multiple policy areas (e.g., health, social care, economic factors). It is therefore logical to examine whether modifiable factors are feasible targets within SES strata, which is what the authors proceeded to do. Participants were grouped into favorable, intermediate and unfavorable lifestyle categories and hazards for incident frailty were generated across levels of SES. There was evidence of a link between favorable lifestyle and lower risk of frailty but this did not materially differ across levels of SES and there was variation between cohorts (which could reflect genuine country-level differences). Other factors which could influence the estimates presented in the paper include competing risk of death and how censoring was handled in the time to

event modelling (the details of which are missing from the paper). Incorporating the time-varying nature of elements of lifestyle (e.g., smoking, alcohol, physical activity and social contact) could also be worth exploring in future studies in order to identifying potentially modifiable targets.

Moving to a factor that is more commonly (though not exclusively) associated with adulthood, Costello et al. undertook an analysis of a large US cohort study (the National Institutes of Health American Association of Retired Persons Diet and Health Study) to examine the relationship between caring for adults and children, and mortality [4]. This is a extremely important area, with the negative impact of caregiving on health outcomes well-documented [5,6]. Somewhat counter-intuitively though not without precedent, in this study caregiving was associated with a lower risk of mortality. The authors suggest a “protective benefit” of caregiving; however, before reaching this conclusion it is important to consider some methodological factors that could be influencing these findings. Firstly, the authors note that there could be biases that led to only healthier people opting to deliver care and take part in the study. This is reasonable and is reflected in data showing 50% of caregivers engaged in ≥ 75 min of physical activity per week compared to 43% of non-caregivers. One way to partly deal with this could be propensity score matching on health-related factors between carers and non-carers. Additional analysis exploring the incidence/-trajectory of other indicators of unhealthy aging (e.g., chronic disease burden, quality of life) would also provide important insights. Another factor that could confound the association between caregiver status and mortality is the change in status over time. In this study, the carer data was only collected at baseline, meaning there was no data on whether and how caregiving status over time. Finally, the study used two different definitions for adult and childcare. For adults, the definition was centered on medical/assistance needs (pushing a wheelchair; lifting) while for children the definition reflected routine childcare (pushing a stroller, playing, lifting; that is, caring for medical needs does not seem to be captured). The study makes direct comparisons between adult and child care but interpretations of this part of the analysis should be undertaken with these differences in definition in mind. In all, caregiving may have some positive benefits in some contexts but addressing the negative effects on health and well-being should continue to be an area of focus for research.

A common factor not incorporated into any of the above-mentioned papers is loneliness, despite it being highly prevalent and relevant to all three outcomes (self-rated general health, frailty, and mortality). Using data from five harmonized cohorts from China, Europe, South Korea and the US (three of which are used in the studies described above), Zhu et al. examined the predictors of transitions in loneliness among older

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adults [7]. The geographic coverage permits novel analysis of the links between loneliness and country-level factors - GDP, population age, civil society participation and urban population proportion – alongside individual-level demographic, medical and social factors. In terms of country-level factors, low GDP, high proportion of urban population, and low civil society participation were all linked with risk of transition from not lonely to lonely, highlighting the importance of public policy in addressing loneliness. In terms of individual factors, poor lifestyle, poor health, low education and female sex all carried an increased risk of transitioning from not lonely to lonely. Returning to the specific context of the other studies in this Special Section, this study highlights the potential role of loneliness as a mediator of many health outcomes. Interestingly, Zhu et al. also analyzed whether these country- and individual-level outcomes were associated with transition from lonely to not lonely and for the most part these were the reverse of the not lonely to lonely analysis (e.g., having chronic disease decreased the likelihood of transitioning from lonely to not lonely). There were, however, some associations that were more difficult to interpret. For example, civil society participation was associated with a lower likelihood of transitioning from not lonely to lonely (i.e., protective) but also a lower likelihood of transitioning from lonely to not lonely. This seemingly inconsistent finding may reflect the highly complex dataset, presence of unmeasured confounders or Type I error.

Epidemiological studies have an important role in generating hypotheses for modifiable risk factors for unhealthy aging. The necessary next steps are to first develop interventions and, later, to test their efficacy. Representing the development phase of technological interventions is the topic of the final study in this Special Section. Satake et al. present the findings of a qualitative study on the views of seventeen older adults of a ‘companion robot’ for loneliness [8]. The robot, Sota, is embedded with large language model technology that enables users to engage in conversation (essentially like a verbal version of ChatGPT or Claude). In-depth interviews and focus groups were conducted with participants based on their experience using the robot. The participants also completed some questionnaires, but the most interesting information comes from the qualitative work, which identified three themes: practical use and functionality, emotional connection and engagement, and ethical and societal reflections. The participants provided honest reflections, and it is probably fair to conclude that while the potential was seen there is further work to be done on conversational quality. The data also include some useful insights into deployment (e.g., perhaps it

would be most effective in situations where people cannot leave their home). Naturally, such tools are only ever likely to be part of the solution to the complex issue of loneliness, further end user engagement will be invaluable in developing further iterations of the technology and directing its use in the real world.

Collectively, the four epidemiological studies presented in this Special Section demonstrate how medical, social and demographic factors across the life course influence health in older age, while also highlighting important methodological challenges in studying these relationships. By exploring older adults’ experiences with an AI-enabled companion robot, the fifth study illustrates the importance of user engagement in the development of evidence-based interventions, an essential part of the process of tackling unhealthy aging effectively.

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Byron Creese 

Department of Psychology, College of Health Medicine and Life Sciences,
Brunel University of London, UK
E-mail address: Byron.Creese@brunel.ac.uk.