

## Editorial: Evidence-based approaches in Aging and Public Health

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15 **Abstract**

16 The past decade has seen increased research on ageing, driven by scientific breakthroughs and a  
17 growing elderly population. Clinical trials have made progress in targeting ageing mechanisms, but a  
18 more holistic approach is needed. There is a growing interest in observational studies and real-world  
19 data. A shift towards more innovative research methodologies that integrate diverse disciplines is  
20 required. This editorial highlights 15 studies which address different aspects of ageing, different  
21 diseases, apply different research methods and include different populations. This change presents  
22 significant challenges, such as ethical considerations and interdisciplinary collaboration.

23 **1 Introduction**

24 The past decade has seen a significant increase in ageing research, driven by scientific breakthroughs  
25 and the need created by a growing global elderly population. Clinical trials have made remarkable  
26 progress in providing insights into the underlying mechanisms of ageing and exploring new  
27 treatments. However, it is crucial to recognize that human ageing is a complex phenomenon that  
28 involves an intricate interplay of biological, social, cultural, and environmental factors. Any effective  
29 approach to ageing research must therefore embrace this complexity.

30 Evidence-based medicine, which relies on randomized controlled trials (RCTs) for better diagnosis  
31 and treatment, often excludes older populations due to their co-morbidities and lower adherence  
32 rates. As a result, there has been a growing interest in observational studies based on real-world  
33 settings and data. These studies can supplement RCTs, monitor long-term cost-effectiveness and  
34 safety, and develop guidelines for treatment use. Given the significant impact of ageing on health,

35 finance, the economy, and society, an evidence-based approach is crucial for understanding disease  
36 causes and prevention. This Research Topic ‘Evidence-based approaches in Aging and Public  
37 Health’ welcomed opinions, reviews, systematic reviews, and original research articles on essential  
38 tools, epidemiological studies, AI (artificial intelligence), and geriatric syndromes.

39 For many years, ageing research has been conducted in isolation, with researchers focusing on  
40 specific pathways or diseases. While this approach yielded valuable insights, it often failed to  
41 consider the interconnectedness of the various factors that contribute to ageing. Today, there is a  
42 growing recognition of the need for a more holistic approach to ageing research. Researchers are  
43 increasingly acknowledging the importance of genetics, lifestyle, environment, and emotional well-  
44 being in shaping the ageing process. This requires a shift towards more innovative research  
45 methodologies that can integrate diverse disciplines and move beyond reductionist approaches.

46 This change presents considerable challenges. Traditional clinical trial designs, developed for single-  
47 target interventions, may not effectively capture the full impact of interventions aimed at the intricate  
48 web of ageing. Ethical considerations become paramount, necessitating nuanced informed consent  
49 procedures that account for the long-term nature of interventions and the potential for unforeseen  
50 consequences. Furthermore, fostering interdisciplinary collaboration, while enriching, requires  
51 constructing bridges between diverse scientific cultures and methodologies. ‘A Call to Action for  
52 Collective Efforts: The apex research institutions’, as a platform for pioneering medical  
53 advancements, must champion this critical transition. We urge scientists, clinicians, policymakers,  
54 and funding agencies to unite in supporting and nurturing to developing innovative clinical trial  
55 designs. Trials incorporating multidimensional endpoints, longitudinal assessments, and adaptive  
56 methodologies will be vital for evaluating holistic interventions.

57 Precision medicine has transformed cancer treatment by leveraging next-generation sequencing and  
58 tailored therapies. This has resulted in the emergence of novel trial designs, including basket and  
59 umbrella trials, master platform trials, and N-of-1 patient-centric studies. Additionally, real-world  
60 data, digital applications, and machine learning are being employed to expedite knowledge  
61 acquisition. Clinical trials have shifted from focusing on specific tumor types to being gene-directed  
62 and histology-agnostic, with personalized treatment plans tailored to individual biomarker profiles  
63 (Fountzilias, et al., 2021). Fostering interdisciplinary collaboration: Encouraging partnerships  
64 between biologists, gerontologists, social and behavioural scientists, data scientists, and ethicists will  
65 be crucial for designing and implementing comprehensive ageing research programs (López-Otín, et  
66 al., 2023). Promoting public engagement and openly discussing the complexities and uncertainties of  
67 ageing research, while emphasizing its potential benefits, will gain public trust and foster broader  
68 understanding.

69 Late-life learning programmes can help answer research questions and enhance our comprehension  
70 of active and healthy ageing. Such programmes can be utilized to target age-related diseases such as  
71 dementia and cognitive decline. Research on the multidimensional health impact of late-life learning  
72 can strengthen national strategies and inform policies. These programmes are cost-effective, scalable,  
73 and suitable for use in low-resource settings. More implementation research is needed to ensure that  
74 these programs reach vulnerable groups and older adults. The COVID-19 pandemic has accelerated  
75 the shift to online learning, promoting digital inclusion (Zeki Al Hazzouri, et al., 2021).

76 Scientific research has advanced significantly in domains like immunology and genetics over the last  
77 30 years. Unfortunately, due to the high failure rate and inefficiencies in the healthcare system,  
78 clinical research is still moving slowly. Innovative approaches are required to solve this, in order to

79 involve patients and produce evidence for novel medical advancements. The COVID-19 pandemic  
80 revealed structural flaws in the way clinical trials are conducted, which spurred scientists to create  
81 patient-centric trials of the future. Deep neural networks, multimodal biomedical AI, and machine  
82 learning have the potential to revitalize clinical research by enhancing image interpretation,  
83 workflow, and drug discovery (Subbiah, 2023). The fast advancements in precision medicine,  
84 immunology, and genomics require adjustments to clinical trial design. Although RCTs are regarded  
85 as the gold standard in drug discovery, they come with a high price and risk. Numerous practical uses  
86 of AI are being investigated as a means of achieving sustainable and optimal medication  
87 development. Utilizing AI models, data are transformed into meaningful insights, accelerating the  
88 process of drug research. Opportunities include how AI can help find focused therapeutics and rare  
89 illness treatments, improve patient recruitment and protocol design efficiency, and use AI to monitor  
90 patients. Furthermore, to help businesses decide whether to engage in AI integration and to ascertain  
91 the areas where regulation will have the greatest influence, this research attempts to identify  
92 opportunities, obstacles, and future implications for AI in RCTs (Gilvary, 2019; Harrer, 2019;  
93 Krittanawong, 2019; Delso, 2021; Gates, 2021).

94 ASReview is an open-source programme that researchers have created to make the process of  
95 screening abstracts and titles for systematic reviews and meta-analyses more efficient. Only a small  
96 percentage of the screened research are deemed significant in the scientific literature, a problem that  
97 our technology is intended to remedy. With the help of this tool, review procedures will be able to  
98 become more transparent and efficient by mitigating the error-prone and inefficient process of  
99 manually screening thousands of research publications (van de Schoot, 2021).

## 100 **Contribution to the Field**

101 It is vital to recognize and take lessons from the health system measures that can improve healthy  
102 ageing. Considering the need for more and better evidence-based policies and care for our ageing  
103 populations, we present 15 papers from across the globe in this Research Topic on ‘Evidence-based  
104 approaches in Ageing and Public Health’ of *Frontiers in Public Health*. These papers cover different  
105 research methods ranging from hospital-based study (Chen et al.) to community based study (Peng et  
106 al.) to epidemiological study (Jiao et al.), and from RCTs (Xu et al.), to studies based on statistical  
107 modeling (Elamin et al.; Ye et al.) to a review (Chen et al.) as well as several systematic reviews with  
108 meta-analyses (Gao et al.; Dai et al.; Li et al.; Zhou et al.)

109 As is to be expected from Public Health as a broad discipline, the diseases and issues addressed in the  
110 15 papers are also wide-ranging. ‘Evidence-based approaches in Ageing and Public Health’ covers  
111 diverse topics such as dentistry, sarcopenia, physical activity, sleep, Alzheimer’s and Parkinson’s,  
112 arterial fibrillation, hip fracture, rehabilitation, unmet needs, medical costs, reducing blood pressure,  
113 inappropriate medications and much more. Interestingly, the overwhelming majority (11/15) of  
114 papers in this collection were submitted from authors based in China, with one study each focusing  
115 on Italy (De Cola et al. ), the United Kingdom (Elamin et al.) , Singapore (Ansah et al.) and Vietnam  
116 (Phi et al.).

117 According to the Chen et al. study, hospitalisation patterns among patients with Alzheimer's disease  
118 (AD) and Parkinson's disease (PD) varied markedly. For hospitalised patients with AD and PD, it is  
119 crucial to apply alternative management, and distinct priorities should be set when developing  
120 primary preventive programmes, identifying care needs, and allocating healthcare resources.

121 [Peng et al.](#) investigated cognition and physical frailty in older persons and found that sleep quality  
122 partially mediates the association between cognitive impairment and physical frailty.

123 [Jiao et al.](#) reported that there are notable regional and national differences in the illness burden of  
124 atrial fibrillation (AF). In terms of incident cases [818,493 (562,871–1,128,695)], deaths [39,970  
125 (33,722–46,387)], and disability-adjusted life years (DALYs) [1,383,674 (1,047,540–1,802,516)] at  
126 the national level, China topped among the list of nations.

127 Patients with mild cognitive impairment (MCI) benefit significantly from Tai Chi in addition to  
128 transcranial direct current stimulation (tDCS) for improved global cognitive performance, memory,  
129 execution function, and attention ([Xu et al.](#)). These results point to the possible application of Tai Chi  
130 and tDCS as a non-invasive brain stimulation regimen and physical exercise to enhance cognitive  
131 function in older persons with MCI.

132 Using a multi-state population model, [Elamin et al.](#) estimated the prevalence of periodontal diseases  
133 and dental caries in the adult population in the United Kingdom. This model gives policymakers a  
134 realistic, evidence-based estimate of future demand for oral health issues. Due to the considerable  
135 time lag in the education and training of oral health professionals, these forecasts allow policymakers  
136 to anticipate future capacity demands proactively rather than reactively.

137 The nature of sarcopenia transitions and estimations of life expectancy with and without sarcopenia  
138 are addressed by [Ye et al.](#) Their results underscore the significance of early detection and treatment  
139 for sarcopenia among older Chinese people, enhancing our knowledge of the connection between  
140 sarcopenia and life expectancy, and offering targeted health education. They noted that sarcopenia is  
141 more common in women, older adults with low education, single people, those with an agriculture  
142 hukou, and smokers, both current and past. Targeted interventions are needed to increase the number  
143 of older people in western China's impoverished and rural areas who do not have sarcopenia.

144 [Chen et al.](#) reviewed factors that influence older persons' medical expenses. The medical costs of  
145 older persons need to be evaluated more thoroughly since they are more likely to develop chronic  
146 illnesses. Financing strategies, multidimensional comparisons, and factor investigations should all be  
147 used to analyse the medical costs incurred by older persons. Furthermore, research should be done on  
148 how rising medical expenses affect Medicare financing for the elderly, healthcare services, and  
149 medical insurance support programmes. In order to lessen the burden on older persons, policy makers  
150 should focus more on the medical costs of these individuals and the factors that influence them and  
151 develop relevant policies in a multifaceted and all-encompassing manner.

152 According to a network meta-analysis by [Gao et al.](#), middle-aged and older persons can significantly  
153 lower their blood pressure with both static and aerobic exercise. Both exercise modalities had a  
154 considerable impact on systolic blood pressure, but not diastolic blood pressure. The SUCRA ranking  
155 results indicate that for middle-aged and older persons, static exercise lowers blood pressure more  
156 effectively than aerobic exercise, and for those with hypertension, appropriate exercise can lower  
157 blood pressure to some extent.

158 In a meta-analysis by [Dai et al.](#), providing traditional Chinese exercises (TCEs) to patients with  
159 chronic heart failure (CHF) had a positive impact on their recovery, primarily by improving LVEF,  
160 VO<sub>2</sub>max, anaerobic threshold, quality of life, and single-item traditional Chinese medicine scores  
161 (fatigue, palpitations, floating limbs, and shortness of breath).

162 According to [Li et al.](#) meta-analysis, lifestyle modification (LSM) is advised as a long-term BP (blood  
163 pressure) control regimen; additionally, TCD bubble is suggested for lowering SBP and RE as a  
164 potential means of lowering BP. Aerobic exercise on its own or combined with resistance exercise  
165 and dietary approaches to stop hypertension (DASH) are recommended for the Prehypertension  
166 (PHT) population with moderate to high quality evidence for BP lowering.

167 According to [Zhou et al.](#), pharmacological interventions can minimise the incidence of potentially  
168 inappropriate medications (PIMs), the number of PIMs per person, the amount of pharmaceuticals  
169 used, and the 30-day readmission rate, all of which can enhance the prognosis of older patients.

170 [De Cola et al.](#) claim that the establishment of a hub-and-spoke network for intense neuro-  
171 rehabilitation has improved regional care services for neuro-rehabilitation while also facilitating the  
172 management of neurological patients by preventing needless long-distance travel.

173 To promote system-wide solutions, [Ansah et al.](#) research discusses the elements that either facilitate  
174 or impede hip fracture recovery. They do this by adopting a feedback perspective. Their study report  
175 that recovering from a hip fracture-related loss of function is largely dependent on two factors: (a)  
176 identifying the difference between one's pre-fracture and current physical functions; and (b) using  
177 psychological resilience to act quickly to address a functional loss through rehabilitation services.

178 According to the results of the ([Phi et al.](#)) study, a large number of elderly Vietnamese individuals  
179 had functional impairments. Those not marital (divorced, separated, single) had the highest  
180 percentage of unmet demands but the lowest rate of care needs among this group. Unmet needs were  
181 more common among rural people with poorer health than among those who lived in cities and had  
182 normal or fair health.

## 183 **Conclusion**

184 The past decade has seen increased research on ageing, driven by scientific breakthroughs and a  
185 growing elderly population. Clinical trials have made progress in targeting ageing mechanisms, but a  
186 more holistic approach is needed. There is a growing interest in observational studies and real-world  
187 data. This editorial recognizes the need to adopt 'Complexity in Ageing Research', and hence we call  
188 for more interdisciplinary collaboration and public engagement. A shift towards more innovative  
189 research methodologies that integrate diverse disciplines is required. This change presents significant  
190 challenges, such as ethical considerations and interdisciplinary collaboration. The research  
191 institutions must champion this critical transition by supporting innovative clinical trial designs and  
192 fostering interdisciplinary collaboration. Encouraging partnerships between biologists,  
193 gerontologists, social scientists, data scientists, and ethicists will be crucial for designing and  
194 implementing comprehensive ageing research programs. Late-life learning programs can help target  
195 age-related diseases such as dementia and cognitive decline. These programs are cost-effective,  
196 scalable, and suitable for use in low-resource settings.

## 197 **2 Article types**

198 Editorial

## 199 **3 Conflict of Interest**

200 *The authors declare that the research was conducted in the absence of any commercial or financial*  
201 *relationships that could be construed as a potential conflict of interest.*

202 **4 Author Contributions**

203 BS has prepared the manuscript draft, while EvT, PS, RK and HAIH has revised it for important  
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