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Adapting health, economic and social policies to address population aging in China

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Despite its rapid economic rise over the past four decades, China now grapples with the challenge of accommodating and supporting its expanding aging population. In 2020, 18% of its population were over age 60, and 2.5% were over age 80, projected to rise to 39% and 10%, respectively, by 2050. This demographic shift places China at the forefront of diverse individual, familial and societal challenges. Here, we review these challenges in the context of emerging breakthroughs in basic and translational research, shifts in healthcare paradigms, evolving socioeconomic and political dynamics, and policy innovations. We synthesize China's current policies toward promoting healthy longevity in the general population, focusing on social health insurance, long-term care insurance, community and home-based care and palliative care, as well as gerontological research, public health prevention, nutritional and medical interventions, while identifying strengths and gaps. Finally, we propose suggestions to promote a more inclusive, resilient and happier aging society within China's distinctive sociopolitical and cultural context.

We are entering a world with an aging population, including an increased proportion of older adults (age 65+; Fig. 1) and increased life expectancy[1]. In 2020, around 17.8% of China's population (250 million) were age 60+[2]. By 2050, China will be one of the countries with the highest percentage (10.3%) of people aged 80+[2]. The number of older individuals with noncommunicable diseases and disabilities continues to rise in China. Approximately 45% of disability-adjusted life years in China can be attributed to health conditions prevalent among older adults, primarily due to cardiovascular diseases, cancer, pain and chronic obstructive pulmonary disease. In addition, the number of people aged 50+ with dementia is projected to grow from the current 12.1 million in 2020 to 66.3 million in 2050 (ref. 3). This indicates a substantial demand for long-term care (LTC) and increased pressure on the healthcare and pension systems. Additionally, it highlights issues such as the rising old-age dependency ratio, growing inequalities, poverty and social exclusion in later life. Similar aging demographic shifts are happening in other countries and regions such as Japan, South Korea, Singapore, Hong Kong Special Administrative Region (SAR) and the Nordic countries; while here we focus on the key challenges and solutions in China, we also reflect on these additional experiences and strategies. Among the many socioeconomic challenges brought in by the ascending aging population in China[4,5], here we first highlight three key challenges.

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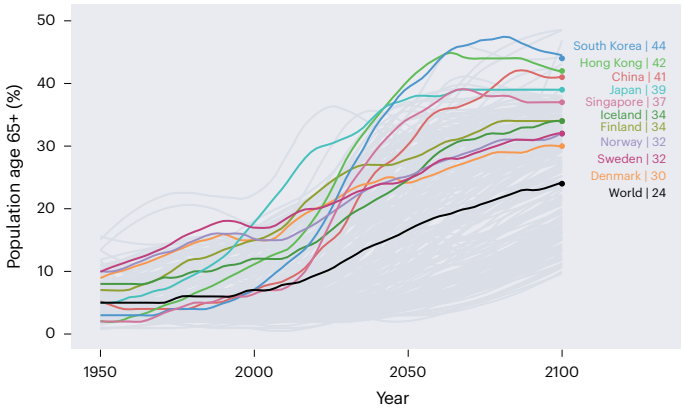

Fig. 1 | A worldwide increase of the aging population (65+) from 1950 to 2100. Data were from the Population Division of the Department of Economic and Social Affairs of the United Nations (World Population Prospects 2024; https://population.un.org/wpp/). Among them, designated countries and Hong Kong SAR (China) are highlighted.

Withering of family care

In the absence of LTC services and relatively low pension levels, families have traditionally been the primary care providers for older people in China. However, changes in family structure, such as smaller family sizes and fewer extended family networks, are reducing the availability and willingness of informal care[6]. Over the past two decades, the steadily declining fertility rates and increased longevity have created a typical '4–2–1' family structure, where one adult child is responsible for caring for two parents and four grandparents, resulting in a heavy burden of family care. Although younger generations feel obligated to care for their aging parents, they increasingly prefer not to live with them. This shift changes the nature of intergenerational support from a traditional model of submission to a more diversified model, intertwined with filial obligation, material interest and emotional intimacy[7]. Additionally, the proportion of 'empty-nest' older adults is rising. In 2021, approximately 60% of older adults were living alone or only with a spouse[8]. This trend highlights increasing challenges in addressing health and care needs of this group.

Increasing inequality and social exclusion in old age

Health and vulnerability in old age vary across the populations. Older adults with lower socioeconomic status tend to experience worse health conditions[9]. Women, in general, live longer than men but tend to have poorer health, reflected in more chronic diseases, higher disability levels and lower physical and cognitive functions[10] (Fig. 2). Regional disparity is a long-observed pattern that the southern and eastern provinces with more medical resources, healthcare facilities and health knowledge have better health quality compared to the mountainous western and northern regions[11]. Given the continuity of the urban–rural gap in terms of access to medical resources and state-sponsored welfare benefits, the rural aging population tends to experience a lower level of healthy aging trajectory[12].

Unequal aging in China is exacerbated by old-age exclusion, a complex process that tends to isolate older adults from social relations. Despite legal efforts to protect their rights and promote cultural virtues of respecting older people, ageism persists, worsening existing social problems such as gender discrimination[13]. Ageism contributes to health issues, social isolation and prevents retirees from reentering the labor market[14]. Although digital technologies have the potential to reduce social isolation, they can also deepen inequalities due to the digital divide[15].

Financial uncertainty in later life

There are uncertainties in later-life financing[16]. People are living longer, and any financial savings and pensions they may have are often inadequate to cover their needs, particularly because of continuously rising inflation and higher medical costs[16]. As a result, a large proportion of older people will depend on government financial subsidies and social pensions. In addition, they require personal and healthcare support, including costly LTC, which may be unaffordable for them[17]. In 2020, 13.1% of older Chinese adults lived below the absolute poverty line, with the rate being even higher in rural areas (16.9%). Poverty rates are higher among those aged 65–74 (14.5%) and those aged 75+ (16.7%) compared to those aged 60–64 (8.3%)[18]. Despite the positive effects of public pension programs in reducing poverty and inequality in rural China, these benefits are not consistently observed among the urban aging population[19].

In the context of these three central challenges as well as other complications arising from an aging population, China has implemented policy changes to address population aging at the individual, family, community and governmental levels. Next, we discuss the latest progress, remaining challenges and potential solutions. Additionally, we examine experiences and lessons from countries and regions with similar cultural contexts, such as Japan, South Korea, Singapore, Hong Kong SAR and the Nordic countries, who have extensive experience in managing aging populations. We aim to offer valuable insights to assist China and other countries in developing a tailored approach to creating an aging-friendly, happier and more productive society.

Multilevel responses to the aging challenges

The World Health Organization (WHO) has emphasized the importance of enabling functional ability through both individual health and supportive environments[20]. Its Healthy Aging Framework highlights the need for integrated care, long-term support systems and age-friendly environments that promote autonomy, participation and dignity throughout the life course. Over the past two decades, China has adopted a comprehensive approach to addressing the challenges of population aging, pursuing a balanced aging governance model with unique characteristics. The '90–7–3' senior-care model aims for 90% of seniors to receive care at home, 7% through community-based hospitals and health centers, and 3% in nursing homes. Additionally, China has piloted LTC insurance (LTCI) to support eldercare. In 2016, the one-child policy was formally abolished to promote a more balanced demographic transition. However, the effects of this policy change on the shrinking workforce and aging population will take time to come into effect[21]. Aligning with the WHO Healthy Aging Framework, China has introduced initiatives to empower older adults with proactive health capabilities, focusing on enhancing medical care, preventive care, psychological support and palliative care services. Cross-sector integration has been promoted to foster a community-based amalgamation of healthcare and care systems[22], bringing together healthcare, community services, housing and digital infrastructure to create enabling environments supportive of aging in place. In 2022, China released a new 5-year plan on eldercare, explicitly reflecting the WHO principles of healthy aging by aiming to boost the health and well-being of older populations through institutional innovation, policy support and financial inputs. This plan includes concrete measures such as digital technology solutions to enhance medical services, improve the coordination between home care and institutional services, and promote the application of traditional Chinese medicine in eldercare[23]. Additionally, a proactive and aging-first strategy for resource deployment and social mobilization has been effectively developed to reduce coronavirus disease 2019 (COVID-19) mortality among the aging population[24]. China's aging strategy views older adults as valuable human resources rather than passive recipients of social benefits. This strategy promotes a positive attitude toward aging and encourages older adults' active participation in social, economic and public affairs to improve their quality of life. It balances responsibilities among families, the state, the market and older individuals. Recognizing the effect of life-course factors on later-life health, the

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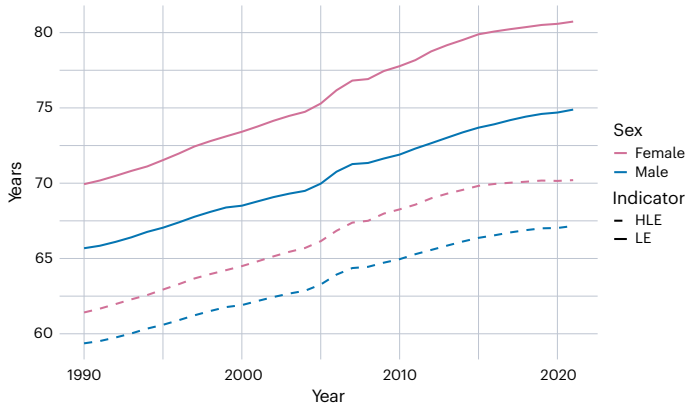

Fig. 2 | Trends in life expectancy and healthy life expectancy at birth in China by sex, 1990–2021. Data are from the Global Burden of Disease Study 2021 (https://vizhub.healthdata.org/gbd-results/). HLE, healthy life expectancy; LE, life expectancy.

strategy prioritizes preventing systemic disadvantages and investing in home and community-based eldercare. China's aging policies feature centralized 'holistic governance' or 'top-level' design while encouraging local innovations in integrated medical care, LTCI and smart aging (智慧养老, *zhìhuì yǎnglǎo*) initiatives. These approaches link economic and social development with aging, focusing on the interplay of social, economic and cultural factors in shaping the challenges and opportunities of population aging.

In the following sections, we detail key efforts ongoing in China implemented to promote healthy longevity in the general population, focusing on social health insurance, LTCI, community and home-based care, palliative care, gerontological research and public health prevention, as well as nutritional and medical interventions.

Reform of the Social Health Insurance Scheme

The merger of the New Cooperative Medical Scheme and the Urban Resident Basic Medical Insurance was completed in 2016, establishing the unified Urban and Rural Residents' Basic Medical Insurance (URRBMI). Recent evaluations of URRBMI indicate improvements in equity, particularly in enhancing healthcare access for rural and lower-income populations[25–28]. However, significant disparities remain, with persistent challenges in benefit adequacy and financial protection for vulnerable groups[29,30].

The National Healthcare Security Administration (NHSA)[31], established in 2018, has had a crucial role in reshaping China's healthcare landscape. One of its key initiatives is the Volume-Based Procurement scheme, which aims to lower drug costs through centralized negotiations and procurement. By 2025, the NHSA conducted nine rounds of national Volume-Based Procurement substantially reducing medication prices and enhancing the availability of specialty medicines crucial for older adults[25]. This initiative has notably improved medication affordability, increased coverage for chronic conditions prevalent among older adults and demonstrated potential for wider national implementation[30,32]. Moreover, recent policy milestones reflect NHSA's accelerated efforts in response to challenges identified during the pilot phases and to improve access and efficacy. Specifically, supporting high-quality development of innovative drugs, accelerating the inclusion of newly approved drugs into the National Reimbursement Drug List[33], targeting nationwide real-time settlement of basic medical insurance funds with designated medical institutions by 2026 (ref. 34) and accelerating interprovincial settlement for outpatient treatment of chronic diseases[35].

Despite these advancements, systematic evaluations suggest that healthcare reforms have improved overall access and equity in medical services, although substantial gaps remain, particularly in rural areas and among disadvantaged populations[29,30]. Challenges such as persistent regional disparities, rising healthcare costs and inadequate coverage for LTC limit the full effectiveness of these reforms[32,36]. To increase the affordability and quality of healthcare for its aging population, China may consider increasing investment in rural healthcare. This could be achieved via targeted government funding, public–private partnerships and incentives for healthcare professionals. Implementing value-based purchasing strategies, such as pay-for-performance initiatives and bundled payments, can help to control healthcare costs while improving outcomes[37]. Policies such as differential co-payments and negotiated pricing can manage pharmaceutical costs while ensuring access to necessary medications, and further balancing innovative and generic drugs[38].

The pilot practice of LTCI

Since 2016, China has initiated LTCI pilot programs to provide essential care and medical services to individuals incapacitated due to old age, illness or disability. In the pilot phase, there were diverse financing, service and operation patterns. Regarding financing, these pilot programs are funded through a combination of individual and employer contributions, government subsidies and social financing[39]. As for service, eight cities (for example, Qingdao and Weihai) have extended benefits beyond individuals with physical disabilities to those with cognitive impairments. As for operation, all cities primarily rely on healthcare security departments for implementation and supervision. By 2022, the pilot programs had expanded to 49 cities, covering 169.90 million participants and benefiting 1.95 million individuals, with about 70% of basic care costs covered[40]. In 2023, national criteria for disability assessment was issued[41], followed by the establishment of professional standards for formal caregivers in 2024 (ref. 42). In 2025, standardized service coding and classification rules were released[43].

Despite its progress, LTCI in China faces several challenges. Although substantial progress has been made in expanding coverage, urban–rural disparities remain. As of 2024, 31 of 49 pilot cities have extended eligibility to both Urban Employee Basic Medical Insurance and URRBMI[44]. However, several cities have not included rural residents, placing continuous burden on eldercare in underdeveloped rural areas. Although the national assessment criteria were released, their implementation is still in its early stages and varies across regions. Financing remains a critical challenge for the sustainability of LTCI, with an overreliance on social medical insurance affecting the sustainability of this policy[36]. Increasing numbers of older adults are relocating to live with their children, raising concerns about differences in entitlement and reimbursement across regions[45]. Additionally, the quantity and quality of the caregivers are concerns.

Future priorities for optimizing LTCI in China include: (1) promoting equity in coverage by extending LTCI to regions not yet covering URRBMI, and ensuring access for older residents in economically underdeveloped rural areas; (2) improving caregiver conditions by enhancing salaries, providing vocational and professional development and offering supportive training on care skills; (3) integrating health and eldercare by reducing barriers for primary healthcare providers serving aged care facilities, and addressing inadequacies in medical services in LTC institutions; (4) promoting home and community-based care by advancing the '90–7–3' policy target through expansion of family and community care services; and (5) innovating financing strategies by promoting new medical insurance payment methods to ensure the sustainability of LTCI. Despite challenges, LTCI has positively affected eldercare services by diversifying financial risks and creating opportunities in the care industry. In response to pilot-phase issues, the NHSA has accelerated policy formulation and is facilitating LTCI nationwide. Integrating sectors such as medical technology, gerotherapeutic interventions and electronic technology is essential for developing a comprehensive and sustainable LTC system.

Table 1 | The list of institutions of National Clinical Research Centers for Geriatric Disorders established in China

No.	Institutions	Center website	Official launch
1	Chinese People's Liberation Army (PLA) General Hospital	https://www.301hospital.com.cn/ncrc/geriatric.html	2020
2	Xiangya Hospital, Central South University	https://ncrcgdxy.csu.edu.cn/	2017
3	West China Hospital, Sichuan University	https://www.wchscu.cn/scientific/science_technology/platform/60370.html	2016
4	Beijing Hospital	https://www.bjhmoh.cn/	2015–2016
5	Huashan Hospital, Fudan University	https://www.huashan.org.cn/hsagingcenter/	2016
6	Xuanwu Hospital, Capital Medical University	https://ncrcgd.xwhosp.com.cn/	2017

Institutional and community-based care services

Since the 1950s, China has provided aged care services to older adults with the greatest needs through welfare institutions and government programs. By the mid-1990s, financial constraints, a limited number of state-run aged care homes and poor care quality led to the decentralization and privatization of former state-run facilities, increasing the number of nongovernmental aged care homes, especially in urban areas[46].

Since 2011, China has implemented policies to encourage the establishment of LTC facilities by the private sector, resulting in substantial expansion in both the public and private sectors[32]. The '14th Five-Year' National Plan for the Development of Aging Affairs and the Aged Care Service System (2021–2025) outlines China's strategy to address population aging, promoting high-quality development in aging industries and services. Objectives include improving the supply of aged care services, building a supportive health system and integrating various service models. Complementary policies include the Outline of the 14th Five-Year Plan for National Economic and Social Development, and the Opinions on Advancing the Construction of the Basic Aged Care Service System. These policies focus on strengthening the aged care service system, establishing an LTCI system and enhancing service accessibility.

Despite these efforts, challenges persist, including high costs, high turnover among care workers and resistance to institutional aged care due to traditional filial piety culture. There is a pressing need for home-based and community-based care solutions to create autonomous, safe and cost-effective environments[47]. During the '13th Five-Year Plan' period (2016–2020), cities such as Beijing, Shanghai, Guangzhou and Chengdu led initiatives for aging-friendly renovations, including installing elevators in old residential complexes, improving community spaces and making home modifications. Typical home modifications include adopting non-slip flooring measures, adding handrails to walls, fitting bathrooms with shower chairs and installing night-lights. During the 14th Five-Year Plan period, these efforts are expanded to benefit more vulnerable older individuals[32].

To address the gap between the eldercare service provision and the growing needs of aging in place, the Central Committee of the Communist Party of China and the State Council released a Guideline on Deepening the Reform of Eldercare Services in December 2024 (ref. 48). This comprehensive policy framework outlines the key measures to build a solid services system for older adults by 2029 and a mature, universally accessible framework by 2035. It centers on a three-tier service network—county-level coordination platforms, township/subdistrict hubs and embedded community facilities—to integrate home-based, community-supported and institutional care, prioritizing medical and old-age care integration, disability prevention and rural–urban equity through rural revitalization partnerships. It leverages market incentives (for example, tax breaks and 'silver economy' development), financial tools (for example, LTCI and infrastructure real estate investment trusts) and technology (for example, AI, robotics and national data platforms), while expanding workforce training and enforcing localized governance to avoid one-size-fits-all approaches. These reforms will balance state guarantees with private-sector innovation and grassroots social mobilization to ensure sustainable, adaptable care for all seniors.

Palliative care in the Chinese aging population

Palliative care aims to prevent and alleviate suffering for patients with life-threatening illnesses, addressing physical, psychological, social and spiritual distress. In 2018, only 0.3% of older individuals with cancer received palliative care, and only 34.1% of cancer hospitals and 15.5% of tertiary general hospitals had a palliative care department or specialist(s)[49]. Government support for palliative care, including financial assistance, favorable legislation and collaborative systems, has greatly improved in recent years[50]. In 2019, the Chinese government published a joint directive, 'guidelines for establishing and improving a comprehensive supervision system for eldercare', to develop a multidisciplinary palliative care model for older adults[50]. The Basic Healthcare and Health Promotion Law, released in 2020, provides legal assurance and a framework for relevant initiatives, including palliative care. Some local governments have begun offering financial reimbursements for palliative care services. However, comprehensive and dedicated funding mechanisms remain limited, with much of the support embedded within broader eldercare financing schemes. For example, between 2021 and 2022, Guangdong province directed at least 55% of its welfare lottery funds to support the construction of a public eldercare service system, including palliative care services in public eldercare[51]. Legislative and regulatory support is also evolving, with recent efforts to ease restrictions on drug accessibility and enhance advanced directives. Since 2011, more lenient regulations have been enacted regarding the prescription and distribution of opioid analgesics[52]. Comprehensive training, infrastructure development and incentive structures for collaboration among policymakers, healthcare providers, technology developers and the community are essential for further progress in palliative care.

Investment in geriatric and gerontological research

A deeper understanding of healthy longevity in China will help policymakers to make more informed decisions. In recent years, China has significantly invested in gerontological research, establishing the National Clinical Research Centers for Geriatric Disorders (between 2015 and 2020) and various aging cohorts. There are currently six hospital-based National Clinical Research Centers for Geriatric Disorders in China (Table 1), which serve as core institutions for the prevention and treatment of major geriatric diseases and health management. These centers integrate research, treatment, care, teaching, prevention, management and policy formulation, providing a comprehensive data-sharing and collaborative platform.

Centenarians are considered one of the most successful models to study human biological aging. Several ongoing cohorts have been launched in regions known for longevity, such as the Chinese Longitudinal Healthy Longevity Study, the China Hainan Centenarian Cohort Study[53], and the Rugao Longevity and Aging Study[54]. Sub-cohorts

such as the Healthy Aging and Biomarkers Cohort Study[55], embedded within the Chinese Longitudinal Healthy Longevity Study, collect more in-depth data by gathering biosamples, including blood and urine. However, challenges remain. These include data representation, full clinical data collection and material sharing (including ethical concerns): for example, there are gender disparities among centenarians[56], limited data and research on emerging risk factors such as psychological health and early-life events, and the need for lifestyle studies spanning early to late life (up to 100+ years) to mitigate potential survival bias[57]. Given the extremely low proportion of adults who live to be over 100 years old, access to large sample cohorts such as the China Kadoorie Biobank[58] and the REACTION[59] study could be considered.

Public health prevention and interventions

Implementing healthy lifestyle interventions including avoidance of tobacco, healthy diets and engagement in physical exercise and social activities. Promoting a healthy lifestyle among older adults in China, including habits such as avoiding tobacco, maintaining a healthy diet, regular exercise and staying socially engaged, is crucial for enhancing longevity and well-being[60]. In 2016, the Central Committee of the Communist Party of China and the State Council enacted the 'Healthy China 2030' plan[61]. This comprehensive blueprint aims to promote healthy living, enhance healthcare services, refine the health industry and establish a foundational medical system accessible to all citizens by 2020, to elevate China's healthcare standards to those of developed nations by 2030. For example, excessive salt intake poses a significant risk for cardiovascular health in China. Consequently, salt reduction initiatives are part of the 'Healthy China 2030'. Since 2017, the Chinese government has implemented the Action on Salt China plan[62], which includes strategies to increase salt awareness, facilitate self-monitoring at home and in restaurants and regulate salt content in processed foods. In 2024, the government launched the Three-Year Weight Management Action Plan (2024–2026)[63]. By creating supportive environments, boosting public awareness and skills in weight control and embedding healthy behaviors across key life settings (for example, workplaces, schools and communities), this initiative aims to curb the rising obesity and metabolic disorders in China. In China, factors such as gender, rural–urban disparities and socioeconomic status significantly affect health equity[32]. Policies aimed at increasing access to healthy behavior changes, boosting social participation among rural older adults, promoting health literacy, and integrating digital technologies into healthcare delivery might narrow these gaps[32]. In line with the initiatives outlined in the Healthy China 2030 Action Plan, the 14th Five-Year Plan for Healthy Aging reiterates the goal of constructing age-friendly communities, encouraging active social participation and physical exercise to enhance the health of older adults.

Towards pharmacological interventions in aging. Preclinical and clinical studies support the application of preventive and interventional strategies, such as exercise, fasting, healthy diets and clinical-evidenced nutritional supplements, to slow down aging and reduce the risks of age-related diseases[64,65]. Understanding the molecular mechanisms of aging and disease is crucial in developing preventive and therapeutic strategies. Some of the most studied longevity pathways include the insulin/insulin-like growth factor 1 (IGF-1), the mammalian target of rapamycin (mTOR), 5′ AMP-activated protein kinase (AMPK), autophagy and sirtuin pathways[66,67]. Preclinical studies show that calorie restriction, fasting and exercise extend lifespan and healthspan by influencing these pathways, although more clinical evidence is needed[64,65]. New research has identified pathways such as cGAS–STING, which links cytosolic DNA detection to inflammation[68]. In the process of aging, DNA breaks accumulate and trigger the cGAS–STING pathway, leading to inflammation and cellular senescence[69]. This pathway has been linked to age-related neurodegeneration[70], and its inhibitors may offer therapeutic benefits for a range of aging-related diseases. Furthermore, epigenetic modifications have a crucial role throughout the aging process. Recent discoveries highlight the importance of epigenetics in the aging process[71], raising the question of whether we can identify disease-specific epigenetic changes and develop targeted therapies.

In recent years, compounds have been discovered that have the potential to delay aging. These compounds target key pathways involved in age-related decline, providing new opportunities to extend life and combat age-related disorders. Promising small molecules include nicotinamide adenine dinucleotide (oxidized form, NAD^+) enhancers (such as nicotinamide riboside and nicotinamide mononucleotide (NMN)), rapamycin, senolytics, metformin, acarbose, spermidine, urolithin A and lithium (Table 2; for details, see ref. 66).

Identifying circulating biomarkers is essential for understanding biological age and developing pharmacological interventions for aging-related disorders, with the latter via noninvasive early diagnosis. During the past years, many circulating biomarkers of aging have been studied, with considerable attention given to biomarkers such as growth differentiation factor 15 (GDF15)[72], chitotriosidase (CHIT1)[73], the C–C chemokine ligand 17 (CCL17)[74], matrix metalloproteinase 2 gene (MMP2), insulin receptor (INSR), CCL5, CCL7 and CHI3L1. Other potential biomarkers include metabolites, exosomes, proteins, RNAs and cell-free DNAs in the circulating systems[75], urine and feces (gut microbiota and their products)[76].

For future perspectives, it is believed the development of methods to quantify biological age will enable the provision of evidence-based personalized medicine and the reduction of healthcare and socioeconomic pressure. Various methods are being developed to quantify biological age, such as DNA methylation age[77], a transcriptome-based aging clock[78] and a proteomic aging clock[79]. While each method has advantages and limitations, more efforts are needed to create a unified biological aging clock that is widely accessible and applicable across populations, such as routine blood tests, to support health promotion.

Conclusion and future perspectives

China is undergoing dramatic demographic shifts, characterized by a rapidly aging population (especially among the 'oldest old') with multimorbidity, including high rates of disability and dementia, declining fertility and rising old-age dependency ratio. These changes pose substantial challenges for individuals, the government and society. In response, China has developed a broad and evolving policy framework to address the needs of its aging population.

A key strength of China's approach lies in its emphasis on system-wide integration and experimentation. China's eldercare strategies integrate healthcare, community services and innovative models such as LTCI, and have improved accessibility, diversified financial risks and enhanced well-being for older adults and their families[32,36,39,80]. Pilot initiatives in community-based care, home-based care models and digital health solutions demonstrate considerable potential for nationwide scalability[32,47]. However, these policies face persistent barriers: pronounced urban–rural disparities, inconsistent LTCI coverage, shortage in the caregiving workforce and training, and financial sustainability concerns[40,41,81,82]. Cultural resistance rooted in traditional values such as filial piety further impedes acceptance of institutional care[47]. Consequently, although local initiatives offer promising models, effectively scaling these pilot programs requires addressing systemic inequalities, strengthening infrastructure and workforce capacity, securing sustainable funding and adaptation of culturally sensitive policies[32,47,82]. Meanwhile, evolving family structures and persistent regional disparities may continue to intertwine, reducing economic productivity, straining public finances, weakening social welfare systems and widening social inequalities. Although China's current upper-middle-income country status provides some capacity to manage these pressures, rising aging-related expenditures risk diverting investments from critical sectors such as education and housing[83].

Table 2 | A summary of small molecules with potential clinical benefits in treating age-related syndromes

Category	Molecule	Targeted condition	Participants	Clinical trial ID	Status or conclusion
NAD^+ precursors	NMN	Hepatic steatosis; liver injury	Healthy individuals with acute binge drink	NCT05882214	Complete, no result published yet
		Mild ulcerative colitis	Age≥18 years old, ≤75 years old	NCT06214078	Recruiting
		Diminished ovarian reserve	Patients with premature ovarian insufficiency	NCT05485610	Recruiting
		Physical performance	Young and middle-aged trained runners	ChiCTR2000035138	NMN increases the aerobic capacity[100]
		Chronic insomnia	Chronic insomnia patients, 65≥age≥18	ChiCTR2200058001	Recruiting
	Nicotinamide	COVID-19; lymphopenia	Patients with COVID-19	NCT04910230	Niacinamide has no significant effect on lymphopenia in participants with COVID-19 disease[101]
Senolytic molecules	Fisetin	Aging; sleep disorders	Aged 45–70 years; Pittsburgh Sleep Quality Index score>5	ChiCTR2500100733	Recruiting
		Brain ischemic stroke	Patients with acute ischemic stroke	NA	Fisetin prolongs therapy window of brain ischemic stroke[102]
	Quercetin	Nonalcoholic fatty liver disease	Patients with Nonalcoholic fatty liver disease	ChiCTR2100047904	Quercetin reduces intrahepatic lipid contents[103]
Anti-inflammatory molecules	Anthocyanin	Dyslipidemia	Patients with dyslipidemia	NA	Anthocyanins improve the anti-oxidative and anti-inflammatory capacity in participants with dyslipidemia[104]
	Curcumin	Nonalcoholic simple fatty liver	Patients with nonalcoholic simple fatty liver	ChiCTR2200058052	Curcumin reduces in hepatic fat content[105]
Glucose modulators	Metformin	Evaluating geroprotective effects in human	Middle-aged and older male participants	NCT06459310	Recruiting
	Acarbose	Cardiovascular-related morbidity and mortality	Coronary heart disease patients aged 50 years old or more	NCT00829660	Acarbose does not lower cardiovascular risk but reduces diabetes incidence[106]
	Henagliflozin	Heart failure; myocardial infarction	Patients with ST-segment elevation myocardial infarction	NCT06187727	Recruiting
Other molecules	Urolithin A[a]	Physical performance	Resistance-trained male athletes	NA	Urolithin A improves muscle strength and endurance[107]
	Taurine	Hypertension	Patients with prehypertension	NCT01816698	Taurine reduces blood pressure and improves vascular function[108]

NA, not applicable. [a]A new phase 2 clinical trial on the effect of urolithin A in Alzheimer's disease was funded very recently (https://www.alz.org/news/2025/alzheimers-association-part-the-cloud-grants-gene-targeting-treatments).

Beyond domestic reforms, China can draw insights from other aging societies with mature eldercare strategies. For instance, Japan has prioritized employment stability and economic security for older adults through pension schemes and financial incentives[84,85]. South Korea has invested heavily in healthcare infrastructure and longevity research, emphasizing the importance of integrated care and preventive health[86–88]. Singapore exemplifies the value of intergenerational support, community–family care partnerships, and flexible financial policies promoting seniors' independence and social participation[89–91]. The Nordic countries combine formal care, informal family support and welfare technology innovations to address caregiver shortages and enhance efficiency[92–95]. Hong Kong SAR offers a notable model for developing age-friendly cities under the UN Decade of Healthy Aging framework[96–98]. Although China's population aging is unique in its speed and sociopolitical and cultural context, these international experiences may still provide valuable lessons in balancing formal services, community/family support and financial protection.

Looking ahead, China faces population aging in an unprecedented context: the digital era. Unlike many countries and regions that aged during the industrial or post-industrial eras, China has the opportunity to leapfrog traditional models by building an integrated, tech-enabled, scalable and person-centered eldercare system. Recent policy frameworks, such as the 2024 Guideline on Deepening the Reform of Eldercare Services[48], reflect this ambition—emphasizing service integration, rural revitalization, technology adoption and cross-sector

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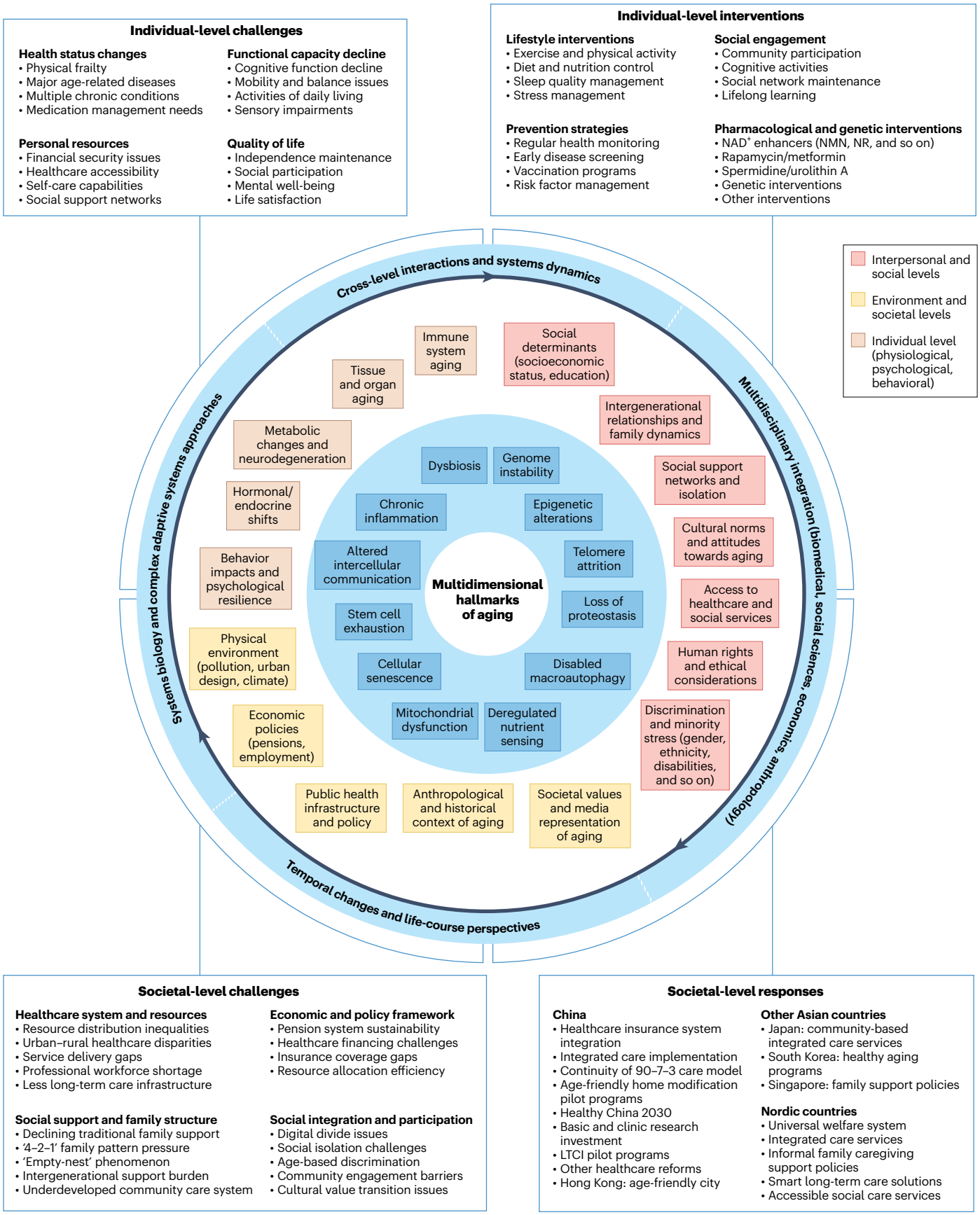

Fig. 3 | A summary of proposed approaches in tackling aging and diseases at molecular, individual and population/societal levels. At the molecular level, a list of 12 hallmarks of aging is presented; in combination with external risk factors (such as environmental, diet and habitual factors), inductions of these hallmarks drive aging and a series of diseases as exemplified in the outward cycle. Challenges (left) and interventions/responses (right) at the individual level (top) and population/societal level (bottom) are presented. NR, nicotinamide riboside.

collaboration. Key elements include developing a three-tiered service network, integrating home, community and institutional care, and leveraging AI and national data platforms. Success, however, will depend not only on innovation and infrastructure, but also on effective regulation, workforce development, equitable regional access and inclusive governance. These reforms align China with the WHO's Decade of Healthy Aging framework, particularly in promoting aging-in-place, integrated LTC and age-friendly environments.

As China's 1950s and 1960s baby boomers retire, strategic preparation for an aging society becomes imperative. Although this Review focused on the health-related response, aging represents a multidimensional societal transformation. Challenges, such as health, education, employment and income disparities, originate early in life and accumulate over time across a lifespan. Thus, promoting healthy longevity in China requires a life-course approach addressing aging not only in later life, but also through investments in early-life and midlife health, education and equity.

In summary, as the nation with the world's largest aging population, China faces substantial social and economic effects from aging. This Review has examined China's policies, progress, challenges and potential solutions regarding population aging. Future work could assess how these government and societal efforts translate into tangible health gains for older adults, such as improvements in healthy life expectancy, shifts in disease patterns and changes in major causes of death. Given China's vast size and pronounced urban–rural and regional disparities, it is equally important to examine differences in policy implementation, their drivers and their effects across contexts (for example, in various regions, urban and rural areas, and administrative levels). Furthermore, understanding how global advances in life sciences and medical technology shape China's technical capacity and policy development in healthy aging would provide a valuable perspective. By implementing targeted strategies and integrating insights from other countries and regions, including Japan, South Korea, Singapore, the Nordic countries and Hong Kong SAR, China can develop a more informed, efficient and compassionate approach to managing aging challenges and advancing healthy longevity nationwide. We further propose a multilevel framework (Fig. 3) for tackling aging challenges and improving quality of life at molecular, individual and population/societal levels—a model potentially valuable to all nations facing population aging.

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Competing interests

E.F.F. is a co-owner of Fang-S Consultation AS (organization no. 931 410 717) and NO-Age AS (organization number 933 219 127); has a material transfer agreement (MTA) with LMITO Therapeutics (South Korea), a cooperative research and development agreement arrangement with ChromaDex[99], a commercialization agreement with Molecule AG/VITADAO, an MTA with GeneHarbor (Hong Kong) Biotechnologies and a data license option agreement with Hong Kong Longevity Science Laboratory (Hong Kong); is a consultant for MindRank AI (China), NYO3 (Norway), AgeLab (Vitality Nordic AS, Norway) and Hong Kong Longevity Science Laboratory (Hong Kong). R.S. is a consultant for Charoen Pokphand Group (Thailand), Aktivo Labs (Singapore), Muhdo Health (UK), MitoQ (New Zealand) and Trustee of the European Society of Preventive Medicine (UK). All other authors declare no competing interests.

Additional information

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