REVIEW ARTICLE

CONTENTS

From longevity to healthy ageing: A conceptual review of the 6W public health preparedness framework

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ABSTRACT
Population ageing is one of the most profound demographic transformations of the 21st century and represents a major public health success driven by advances in medicine, public health, and socio-economic development. By 2050, the global population aged 60 years and above is projected to exceed 2.1 billion, with the most rapid increases occurring in low- and middle-income countries. However, gains in life expectancy have not been matched by equivalent improvements in healthy life expectancy, resulting in longer survival with chronic disease, disability, and functional decline. This manuscript examines the concept of healthy ageing through a public health lens, emphasizing the importance of functional ability, quality of life, and equity across the life course. Using the 6W framework, the paper explores why population ageing matters, what demographic and epidemiological transitions are occurring, who is affected, where interventions are most effective, when action is required, and how public health systems must respond. Key challenges, including multimorbidity, polypharmacy, disability, loneliness, and health system strain, are discussed alongside opportunities offered by primary health care, community-based interventions, digital health, and policy reform. The manuscript highlights the critical role of preparedness in transforming longevity into healthy ageing and underscores the need for integrated, life-course-oriented, and equity-focused public health strategies.

KEY WORDS: life expectancy, HALE, multimorbidity, disability, life-course approach

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INTRODUCTION
Population ageing is reshaping societies worldwide and represents one of the most profound demographic shifts of the 21st century. Extended survival has not been accompanied by equivalent gains in healthy life expectancy, resulting in longer years lived with chronic disease, disability, and functional decline. As populations age, health systems face rising demands related to multimorbidity, long-term care, and social support. These changes necessitate a reconceptualization of ageing within a public health preparedness framework that prioritizes functional ability, equity, and life-course strategies.

WHY LONGEVITY MATTERS
Longevity refers to the length of time an individual or a population lives and is most commonly measured using life expectancy, which represents the average number of years a person is expected to live under prevailing mortality conditions [1]. From a public health perspective, longevity is widely regarded as a major societal achievement, reflecting sustained advances in medicine, sanitation, nutrition, education, and socioeconomic development [2]. The dramatic increase in global life expectancy since the mid-20th century has largely resulted from reductions in infant and maternal mortality, effective control of infectious diseases through vaccination and antibiotics, and improvements in living conditions[3, 4]. Improvements in sanitation, vaccination, nutrition, maternal and child health, disease control, and socio-economic conditions have collectively contributed to unprecedented survival gains worldwide[3, 5]. Global life expectancy increased from approximately 46 years in 1950 to over 73 years by 2023, reflecting sustained progress across most regions [1]. By 2050, one in five people globally will be aged 60 years or older, fundamentally reshaping demographic structures, dependency ratios, and health system demands [1]. Living longer does not necessarily equate to living healthier. Many populations are experiencing extended years lived with disability, multimorbidity, and reduced

functional capacity, shifting the public health focus from mortality reduction to morbidity management and wellbeing promotion [6]. A reconceptualization of ageing is needed that moves away from disease-centred models toward approaches prioritizing functional ability, independence, dignity, and quality of life.

GLOBAL POPULATION AGEING AND LIFE EXPECTANCY TRENDS

Addressing this paradox requires a reconceptualization of ageing that moves away from disease-centred models toward approaches that prioritize functional ability, independence, dignity, and quality of life across the life course. Contemporary public health frameworks emphasize that increases in life expectancy alone are insufficient indicators of population health, as many societies experience widening gaps between life expectancy and healthy life expectancy (HALE). This gap reflects the growing burden of years lived with disability (YLDs), driven by chronic diseases, multimorbidity, and functional decline among ageing populations. As a result, healthy ageing is increasingly defined by the ability to maintain intrinsic capacity and functional ability rather than survival alone. This shift underscores the need for health systems and policies that focus on reducing disability, delaying functional decline, and improving quality of life, thereby ensuring that longevity gains translate into healthier years lived rather than prolonged morbidity[5, 8, 9].

DEMOGRAPHIC AND EPIDEMIOLOGICAL TRANSITIONS

The demographic transition, characterized by sustained declines in fertility and mortality, has profoundly reshaped population age structures across the world, leading to a rapidly growing proportion of older adults. Recent evidence highlights that reductions in infant and child mortality driven by expanded immunization coverage, improved maternal and neonatal care, and strengthened infectious disease control have been central to these shifts, particularly in low- and middle-income countries [10, 11]

In parallel, the epidemiological transition has resulted in a marked shift in disease burden from communicable diseases to non-communicable diseases (NCDs), including cardiovascular diseases, diabetes, cancers, and chronic respiratory conditions. This transition has been accelerated by population ageing, urbanization, changing lifestyles, and environmental exposures, leading to an increasing prevalence of multiple chronic conditions among older adults[6, 9]. Consequently, ageing populations now require long-term, integrated, and person-centred care models that move beyond episodic and disease-specific approaches to address multimorbidity and functional decline effectively.

AIM

This conceptual review reframes population ageing through a public health preparedness lens. It distinguishes longevity from healthy ageing by emphasizing functional ability and life-course equity. Using the 6W framework, it organizes ageing challenges and identifies priority strategies, including primary health care strengthening, integrated care models, surveillance, and multisectoral policy action.

REVIEW AND DISCUSSION

CONCEPTUAL APPROACH

This manuscript adopts a conceptual synthesis approach to examine healthy ageing through a public health preparedness lens. It integrates the World Health Organization's definition of healthy ageing with life-course and health systems perspectives. This paper synthesizes existing evidence and organizes it using the 6W framework. This approach facilitates a comprehensive analysis that connects theory, demographic and epidemiological trends, and policy action within a coherent public health framework.

CONCEPTUALIZING HEALTHY AGEING

The World Health Organization (WHO) defines healthy ageing as "the process of developing and maintaining the functional ability that enables wellbeing in older age"[4]. This definition moves beyond chronological age and disease absence, emphasizing what individuals can do and value throughout later life. Functional ability is shaped by intrinsic capacity (physical and mental capacities), environmental factors, and the interaction between the two. Healthy ageing is inherently a life-course process. Health trajectories in older age are strongly influenced by exposures, behaviours, and social determinants accumulated from early childhood through adulthood [7]. Consequently, policies that promote physical activity, healthy diets, tobacco cessation, and reduced harmful alcohol use benefit not only older adults but the entire population. The WHO Decade of Healthy Ageing (2021–2030) underscores global commitment to creating age-friendly environments, aligning health systems to older populations, providing integrated long-term care, and fostering research and

innovation[5]. These principles form the foundation of a comprehensive public health response to ageing.

PUBLIC HEALTH PREPAREDNESS AND MEASURING SUCCESS

Public health preparedness is central to transforming increased longevity into healthy ageing. Effective preparedness requires robust surveillance systems to monitor key ageing indicators such as life expectancy, healthy life expectancy (HALE), disability prevalence, and functional ability[4]. These indicators help clarify what is changing in ageing populations and who is most affected, thereby guiding evidence-based public health planning[4]. Surveillance data also inform when and where interventions are required across the life course and within specific demographic and geographic contexts[16]. Preparedness further depends on policy frameworks that integrate ageing into national development strategies, promote age-friendly environments, and ensure financial protection and social security[5, 17]. These measures address why population ageing must be prioritised within public health systems and how multisectoral action can prevent avoidable disability and dependency[4, 5]. Importantly, success in public health preparedness should not be assessed solely by survival gains, but by improvements in functional ability, independence, and quality of life[4]. Standardised instruments assessing activities of daily living, instrumental activities of daily living, and perceived wellbeing provide critical insights into whether ageing populations are living healthier and more autonomous lives [18].

Within this preparedness context, the 6W framework for healthy ageing offers a structured public health lens to translate data and policy into action. By systematically addressing who is ageing, what changes occur, when vulnerabilities emerge, where inequalities persist, why ageing trajectories diverge, and how health systems and societies should respond, the framework operationalises preparedness across surveillance, policy, and service delivery[4, 17]. The 6W approach ensures that public health preparedness moves beyond extending life expectancy to sustaining functional ability, equity, and wellbeing throughout the ageing process[5].

KEY INSIGHTS

This section synthesizes the principal insights emerging from the conceptual analysis of population ageing. It highlights the growing burden of multimorbidity, disability, and social isolation, and underscores the implications of demographic and epidemiological transitions for health systems. Using the 6W framework, the analysis identifies critical leverage points for intervention across the life course, emphasizing functional ability, integrated care, and equity.

LONELINESS AS AN EMERGING PUBLIC HEALTH CHALLENGE

Loneliness and social isolation have increasingly been recognized as major global public health challenges, affecting a substantial proportion of older adults across all regions of the world. Recent estimates indicate that approximately one in four older adults experiences social isolation, with comparable prevalence observed in high, middle and low-income countries [12]. A growing body of post-2020 evidence demonstrates that loneliness is associated with elevated risks of cognitive decline and dementia, cardiovascular disease, stroke, depression, anxiety, and premature mortality, independent of traditional risk factors [6, 13]. From a biological perspective, chronic loneliness is linked to sustained activation of stress pathways, including increased cortisol secretion, systemic inflammation, and immune dysregulation, which contribute to the onset and progression of chronic non-communicable diseases[14]. Recognizing the scale and health impact of loneliness, the World Health Organization has recently established an international commission on social connection, underscoring that the health risks associated with loneliness are comparable to those of well-established behavioural risk factors such as smoking and physical inactivity [12].

SOCIAL ISOLATION AND LONELINESS AS EMERGING PUBLIC HEALTH CHALLENGES

Social isolation and loneliness, while closely related, represent distinct but overlapping public health concerns that have gained increasing attention in ageing research and policy. Social isolation refers to the objective lack of social contacts, relationships, or participation in social activities, whereas loneliness is a subjective experience reflecting the perceived gap between desired and actual social connections. Both conditions are increasingly prevalent among older adults due to factors such as retirement, bereavement, declining mobility, sensory impairments, chronic illness, and reduced community engagement [12, 14]. Recent global evidence indicates that social isolation and loneliness are widespread across all regions, affecting approximately one in four older adults, with similar prevalence observed in high, middle and low-income countries [12]. Both conditions are strongly associated with adverse health outcomes, including increased risks

of depression, anxiety, cognitive decline, dementia, cardiovascular disease, stroke, frailty, and premature mortality [9, 13]. Emerging evidence also links social isolation to poorer health behaviours, reduced adherence to medical treatment, delayed healthcare seeking, and accelerated functional decline, thereby contributing to increased years lived with disability and reduced healthy life expectancy.

From a biological perspective, prolonged social isolation and loneliness activate chronic stress pathways, including dysregulation of the hypothalamic–pituitary–adrenal axis, elevated cortisol levels, systemic inflammation, and impaired immune function, which collectively increase vulnerability to non-communicable diseases [14]. The COVID-19 pandemic further highlighted the health consequences of social disconnection among older adults, reinforcing the need to address social relationships as fundamental determinants of healthy ageing [12]. Recognizing their substantial health impact, the World Health Organization has framed social isolation and loneliness as critical public health priorities and has established an international commission on social connection. This initiative emphasizes that the health risks associated with social disconnection are comparable to those of established behavioural risk factors such as smoking, physical inactivity, and obesity, and calls for integrated, community-based, and health system–led interventions to strengthen social participation and connectedness in later life [12].

ROLE OF TECHNOLOGY AND INNOVATION

Digital health innovations offer significant opportunities to support healthy ageing. Telemedicine improves access to care, particularly for older adults with mobility limitations or those living in underserved areas [15]. Remote monitoring, mobile health applications, and wearable devices enable early detection of deterioration, support self-management, and enhance patient engagement. However, digital solutions must address barriers such as digital literacy, accessibility, and equity to avoid widening health disparities.

THE 6W FRAMEWORK FOR HEALTHY AGEING

WHY

Multimorbidity, polypharmacy, and disability have emerged as central challenges of population ageing, largely driven by increasing life expectancy and the cumulative burden of chronic conditions[5]. Multimorbidity, commonly defined as the coexistence of two or more chronic conditions, is now highly prevalent among older adults and is strongly associated with reduced functional ability, poorer quality of life, and increased healthcare utilization, particularly in ageing societies[9]. The growing prevalence of multimorbidity has contributed to widespread polypharmacy, which increases the risk of adverse drug reactions, drug–drug interactions, and treatment burden, especially in older populations with altered physiological reserves[6]. In parallel, gains in longevity have resulted in a substantial rise in years lived with disability, predominantly due to non-fatal but disabling conditions such as musculoskeletal disorders, stroke, dementia, and sensory impairments, shifting the public health focus from premature mortality to prolonged morbidity[9]. This transition underscores the need for person-centred, coordinated, and function-focused models of care that address complexity rather than single diseases.

WHAT

Functional decline represents a key consequence of population ageing and is characterized by age-related reductions in mobility, balance, muscle strength, vision, and hearing, which substantially increase the risk of falls, injuries, social isolation, and loss of independence among older adults [5]. As functional ability declines, the demand for long-term care, rehabilitation services, and assistive technologies rises, placing growing pressure on health systems and increasing healthcare expenditure as well as the physical, emotional, and financial burden on families and caregivers [9]. These trends necessitate a shift in health system responses from acute, episodic, disease-focused care toward integrated, person-centred, and continuous care models that prioritize the maintenance of intrinsic capacity and support independent living in older age [8].

WHO

While older adults are the primary beneficiaries of healthy ageing initiatives, responsibility for promoting and sustaining healthy ageing is shared across multiple stakeholders, including families and informal caregivers, primary and specialist healthcare providers, public health professionals, policymakers, community and civil society organizations, and international agencies. Contemporary frameworks emphasize that coordinated, multisectoral engagement is essential to address the complex health, social, and environmental determinants of ageing and to ensure that health systems, social protection mechanisms, and community environments are responsive to the needs of ageing populations [5, 19].

WHERE

Effective healthy ageing interventions operate across multiple settings, including primary health care, community and neighbourhood environments, homes, workplaces, educational institutions, hospitals, long-term care facilities, and increasingly, digital and virtual platforms. Primary health care serves as the cornerstone of these interventions by enabling prevention, early detection of health risks, continuity of care, and coordination across services, particularly for older adults with complex health needs [5]. Community-based and home-centred settings further support functional ability, social participation, and independent living, while digital health platforms enhance access to care, monitoring, and self-management, especially for populations with mobility or geographical barriers [9, 11].

WHEN

Timely intervention across the entire life course is essential for promoting healthy ageing, as exposures and behaviours accumulated from early life through older age significantly influence health outcomes in later life. Evidence from recent life-course frameworks highlights that early-life nutrition, education, and preventive health measures shape intrinsic capacity and resilience in adulthood, while effective management of behavioural and metabolic risk factors during midlife can substantially reduce the risk of chronic disease, functional decline, disability, and dependency in older age [5, 11].

WAY FORWARD- TRANSLATING LONGEVITY INTO HEALTHY AGEING

The sixth "W" of the healthy ageing framework focuses on what must be done to ensure that gains in longevity are translated into healthier, more autonomous, and dignified lives for ageing populations. Public health responses must move beyond disease-centred and episodic care towards integrated, life-course-oriented, and equity-focused strategies that address the complex biological, social, and environmental determinants of ageing. Strengthening primary health care (PHC) is central to this response. PHC provides the most effective platform for prevention, early detection of risk factors, continuity of care, and coordination of services for older adults experiencing multimorbidity and functional decline. Evidence consistently shows that health systems with a strong PHC orientation are better equipped to manage chronic conditions, reduce avoidable hospitalisations, and support functional ability in older age [4, 17].

A second priority is the development of integrated and person-centred care models that respond to the growing burden of multimorbidity, polypharmacy, and disability. Traditional disease-specific models are increasingly inadequate for ageing populations with complex health needs. Integrated care models that link health services, long-term care, rehabilitation, and social support have been shown to improve functional outcomes, patient experience, and health system efficiency[8,9]. Such models should prioritise maintenance of intrinsic capacity, shared decision-making, and continuity of care across settings. Addressing the social determinants of healthy ageing is equally critical. Socioeconomic conditions, housing, transportation, education, and opportunities for social participation strongly influence ageing trajectories and contribute to inequalities in health and functional ability. Public health strategies must therefore adopt multisectoral approaches that promote age-friendly environments, reduce social isolation, and strengthen community engagement [19]. The increasing recognition of loneliness as a major public health risk factor further highlights the importance of community-based interventions and social prescribing to enhance social connectedness in later life [12, 13].

Public health preparedness also requires robust surveillance and monitoring systems to track key ageing indicators, including life expectancy, healthy life expectancy (HALE), disability prevalence, and functional ability. Standardised instruments assessing activities of daily living, instrumental activities of daily living, and participation provide essential evidence for evaluating whether ageing populations are living healthier and more autonomous lives [18]. Such data are critical for guiding policy, planning services, and monitoring progress towards healthy ageing goals.

Digital health and technological innovation offer important opportunities to support healthy ageing when implemented in an inclusive and equitable manner. Telemedicine, remote monitoring, and assistive technologies can improve access to care, enhance self-management, and support independent living, particularly among older adults with mobility limitations or those living in underserved areas [15]. However, these approaches must address barriers related to digital literacy, affordability, and accessibility to prevent the widening of existing health inequalities. In summary, the sixth W emphasises that preparedness for population ageing requires coordinated and sustained public health action. By strengthening primary health care, integrating services, addressing social determinants, improving surveillance, and leveraging technology, public health systems can ensure that longer lives are

accompanied by improved functional ability, independence, and wellbeing [4, 20].

CONCLUSIONS

Healthy ageing within a public health preparedness perspective, using the 6W framework to structure system-level responses. Strengthening primary health care, integrating services, addressing social determinants, improving surveillance, and leveraging equitable digital innovation are essential. Ultimately, success should be measured not only by survival, but by sustained functional ability, independence, and dignity.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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