

Healthy Ageing and Longevity Science in Malaysia: Public Health Challenges and Opportunities

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Abstract

Malaysia is undergoing a demographic transition that is increasing the importance of healthy ageing as a public health priority. Longer life expectancy is a major social achievement, but longevity alone does not guarantee that additional years are lived in good health. The distinction between lifespan and healthspan is therefore increasingly important for public health planning. This paper examines the emerging role of longevity science in Malaysia and considers how its principles can complement established healthy-ageing strategies. It adopts a narrative and policy-oriented review approach, drawing on public health literature, Malaysian policy documents, international healthy-ageing frameworks, demographic evidence, and the candidate's broader doctoral work on longevity science and ageing policy. The analysis is organised around six interrelated challenges: demographic transition and chronic disease, the healthspan gap, prevention and life-course health promotion, health-system readiness and long-term care, technological and biomedical innovation, and equity, governance and public trust. The paper argues that longevity science has public health value when it is framed not as the pursuit of indefinite lifespan extension but as an evidence-informed effort to preserve functional ability, delay preventable morbidity, strengthen prevention, and improve quality of life across the life course. Malaysia already possesses policy foundations for active and healthy ageing, but implementation requires stronger integration across primary care, community services, social protection, long-term care, health literacy, digital health, research and innovation governance. Emerging technologies may contribute to risk prediction, monitoring and personalised prevention, but their adoption should be proportionate to evidence, affordability, ethical safeguards and population need. A public-health model of longevity should therefore prioritise healthspan, equity and prevention before high-cost interventions. The paper proposes an integrated policy direction linking healthy ageing, geroscience-informed prevention, community capacity, technology assessment, research governance and age-friendly systems. This approach

can support Malaysia's transition towards an ageing society while ensuring that added years of life are accompanied by better health, independence, dignity and participation.

Keywords: healthy ageing; longevity science; healthspan; public health; ageing population; Malaysia

1. Introduction

Population ageing is one of the defining public health transformations of the twenty-first century. Improvements in sanitation, nutrition, socioeconomic conditions, disease prevention and medical care have enabled people in many countries to live longer. Yet the success represented by longer life expectancy also produces a new policy question: are populations merely living longer, or are they living longer in good health? This distinction has moved healthy ageing, functional ability and healthspan to the centre of contemporary public health.

Malaysia is experiencing this transition at a pace that makes the question particularly relevant. Malaysian government information defines older persons as those aged 60 years and above and anticipates that the country will reach the threshold of an ageing nation when approximately 15% of the population is aged 60 or older by 2030 (Government of Malaysia, 2026a). The National Health and Morbidity Survey programme has similarly highlighted the implications of population ageing for physical health, mental health and social support systems (Institute for Public Health, 2025). These changes are not simply demographic statistics. They affect primary care, hospital utilisation, long-term care, household caregiving, labour participation, retirement security, community design and the fiscal sustainability of health and social systems.

The candidate's wider doctoral work defines longevity science broadly as an effort to extend healthy functional years through a combination of prevention, lifestyle approaches, diagnostics and emerging biomedical knowledge. It also identifies a central tension: extending lifespan without improving healthspan may increase the number of years lived with disability. That framing is highly compatible with public health because it shifts attention away from longevity as an individual consumer aspiration and towards the distribution of healthy years across the population.

Healthy ageing and longevity science overlap but are not identical. Healthy ageing is well established in public health and focuses on maintaining functional ability, participation, wellbeing and supportive environments as people age. Longevity science is a newer and more

heterogeneous field drawing from epidemiology, preventive medicine, geroscience, behavioural science, biomarkers, digital health and, at its more experimental edge, biotechnology. The public health opportunity lies in identifying which elements of longevity science can strengthen prevention and healthy ageing without allowing technological enthusiasm to displace proven population-health measures.

This distinction is important in Malaysia. A health system preparing for population ageing must manage current burdens of non-communicable disease while simultaneously developing long-term care, strengthening community services, improving health literacy and considering rapidly evolving technologies. The Thirteenth Malaysia Plan 2026–2030 recognises preparation for an aged nation as a priority and refers to the National Ageing Blueprint 2025–2045 as a framework for addressing ageing challenges holistically (Ministry of Economy Malaysia, 2025). This creates a timely policy window in which longevity science can be considered within, rather than outside, mainstream public health planning.

This paper therefore examines healthy ageing and longevity science in Malaysia from a public health perspective. It does not evaluate the clinical efficacy of individual anti-ageing products or experimental therapies. Instead, it asks how a healthspan-oriented longevity framework can contribute to prevention, health-system preparedness and policy development. The central argument is that longevity science will have greatest public value when it is governed by evidence, equity and prevention, and when its innovations are integrated with established healthy-ageing priorities rather than treated as substitutes for them.

2. Problem Statement and Rationale

Malaysia's demographic transition creates a multidimensional public health challenge. A larger older population will increase demand for services addressing multimorbidity, disability, frailty, rehabilitation, mental health, medication management and long-term care. At the same time, ageing is not synonymous with disease. Public policy must avoid framing older people solely as dependants or healthcare consumers. The National Policy for Older Persons emphasises independence, dignity, participation, lifelong learning, protection, intergenerational engagement and research, illustrating that healthy ageing requires social as well as medical responses (Government of Malaysia, 2026b).

The core problem is therefore not population ageing itself, but the possibility that gains in lifespan will outpace gains in healthy and independent life. The candidate's doctoral material

describes healthspan as the period of life lived in good health without chronic disease or age-related disorders and identifies the gap between lifespan and healthspan as a major concern. This provides a useful conceptual starting point. When preventable disease occurs earlier, or disability persists for longer, individuals experience reduced quality of life while families and health systems absorb greater care burdens.

A second problem concerns fragmentation. Healthy ageing touches multiple sectors, yet services and policies may be organised around separate diseases, institutions or administrative responsibilities. Prevention can become disconnected from elder care; social care can become disconnected from health care; technological innovation can advance separately from public health priorities; and private longevity services can develop faster than population-level governance.

A third problem is unequal access. New diagnostics, digital monitoring and personalised interventions may initially be concentrated among affluent urban groups. If longevity science becomes primarily a premium consumer market, it could widen differences in healthy life expectancy rather than narrow them. A public health approach must therefore ask not only whether an intervention is innovative, but who benefits, who pays, what evidence supports it, and whether resources could achieve greater health gain through more accessible interventions.

These challenges justify an integrated review of healthy ageing and longevity science that places healthspan, prevention, equity and system readiness at the centre of Malaysia's response.

3. Objectives and Guiding Questions

This paper has four objectives. First, it examines the relevance of healthspan and longevity science to Malaysia's population-ageing agenda. Second, it identifies major public health challenges associated with longer lives, including chronic disease, functional decline, long-term care needs, health-system capacity and inequality. Third, it evaluates opportunities for integrating prevention, community support, digital health, geroscience-informed thinking and responsible innovation into healthy-ageing policy. Fourth, it proposes a practical public health framework for positioning longevity science within Malaysia's existing policy environment.

The guiding questions are: (1) What are the principal public health implications of Malaysia's transition towards an ageing society? (2) How can the concept of healthspan strengthen the country's healthy-ageing strategy? (3) Which elements of longevity science have plausible relevance to population health and prevention? and (4) What governance principles are

required to ensure that longevity-related innovation supports equitable, evidence-informed public health goals?

4. Methodology

This paper uses a narrative, policy-oriented review design. This approach is appropriate because the purpose is conceptual synthesis rather than estimation of a pooled intervention effect. The review draws on four categories of material: international healthy-ageing and geroscience literature; Malaysian demographic and public health information; national ageing and health policy documents; and themes developed in the candidate's doctoral work on longevity science, regenerative medicine, healthspan and ageing policy.

The analytical process was guided by public health relevance. Material was organised around demographic transition, disease burden, functional ability, prevention, care systems, technology and innovation, equity, governance and implementation. The candidate's existing work was used as a thematic foundation, particularly its emphasis on the distinction between lifespan and healthspan, preventive infrastructure, community support, technological integration and the potential inequality associated with high-cost longevity interventions. Claims requiring policy currency were cross-checked against contemporary official Malaysian and World Health Organization sources.

The review deliberately distinguishes established public health measures from emerging or experimental longevity interventions. Lifestyle modification, vaccination, screening, management of cardiovascular and metabolic risk, falls prevention, rehabilitation, social participation and age-friendly care have established relevance to healthy ageing. By contrast, many biomarker-driven, regenerative or putative age-modifying interventions remain heterogeneous in evidence, regulation, accessibility and clinical indication. They are therefore discussed as areas requiring research and governance rather than as proven population-health solutions.

No primary human participants, patient records or identifiable personal data were used for this paper. Consequently, it presents no original clinical outcomes and makes no claim of causal effectiveness for any specific longevity intervention. This limitation is intentional and preserves the paper's role as a conceptual public health analysis suitable for supporting the candidate's broader doctoral research.

5. Literature Review: Healthy Ageing, Healthspan and Longevity Science

Healthy ageing has evolved from a narrow focus on disease absence towards a broader understanding of functional ability and wellbeing. The World Health Organization's Decade of Healthy Ageing emphasises changing attitudes towards age, developing age-friendly communities, delivering integrated person-centred care and ensuring access to long-term care. The WHO South-East Asia Regional Strategy on Healthy Ageing 2024–2030 further translates these priorities into regional action across governance, communities, financing, service delivery, workforce, rights and data systems (World Health Organization Regional Office for South-East Asia, 2025).

This broader framework is valuable because chronological age alone does not determine health. Two people of the same age may have very different levels of mobility, cognition, social support, disease burden and independence. Healthy ageing therefore depends on interactions among intrinsic capacity, environments, healthcare access, socioeconomic circumstances and behaviour. From a policy perspective, the objective is not to eliminate ageing but to preserve the capabilities that allow people to live meaningful and independent lives.

The concept of healthspan complements this framework. Healthspan focuses attention on the quality and functional content of added years. In practical public health terms, increasing healthspan can mean delaying the onset of diabetes, cardiovascular disease or frailty; preventing avoidable disability; maintaining cognition and mobility; and reducing the duration of severe dependency near the end of life. It also provides a more socially relevant benchmark than lifespan alone because it connects longevity to lived experience.

Geroscience adds another layer by examining biological processes of ageing that contribute to multiple chronic diseases. López-Otín et al. (2013) described interconnected hallmarks of ageing including genomic instability, telomere attrition, epigenetic alterations, loss of proteostasis, deregulated nutrient sensing, mitochondrial dysfunction, cellular senescence, stem-cell exhaustion and altered intercellular communication. Subsequent work has expanded this framework. The public health significance of geroscience is conceptual as well as biomedical: if common ageing mechanisms contribute to several diseases, prevention may eventually move beyond single-disease models towards interventions that preserve resilience across organ systems.

However, translation from biological insight to population benefit is not automatic. Public health requires evidence of safety, effectiveness, feasibility, cost-effectiveness and equitable access. A biological mechanism can be scientifically compelling without yet supporting routine population-level intervention. This distinction is particularly important in a commercial environment where the language of anti-ageing, regeneration and personalised medicine can move faster than regulatory consensus.

Malaysia's policy environment already contains many principles compatible with a healthspan approach. The National Policy for Older Persons seeks to promote independence, dignity, respect and participation and includes strategies relating to advocacy, lifelong learning, protection, governance, intergenerational engagement and research (Government of Malaysia, 2026b). The National Health Policy for Older Persons also recognised the need for coordinated and comprehensive healthcare for older populations (Ministry of Health Malaysia, 2008). More recently, the National Ageing Blueprint 2025–2045 and the Thirteenth Malaysia Plan have placed ageing preparedness, long-term care, social protection, skills and wellbeing within a broader national development framework (Ministry of Economy Malaysia, 2025).

Taken together, these literatures suggest that longevity science should not be treated as a separate specialty operating at the margins of public health. Its most useful concepts—healthspan, prevention, biological resilience, early risk identification and personalised risk reduction—can be integrated into existing healthy-ageing systems, provided that innovation remains subject to evidence and equity.

6. Demographic Transition, Chronic Disease and the Healthspan Gap

Malaysia's ageing transition will reshape patterns of health need. Ageing increases exposure time to risk factors and is associated with higher prevalence of many chronic conditions. Yet the policy response cannot simply expand disease treatment after illness develops. A healthspan strategy requires earlier prevention across the life course.

Non-communicable diseases are especially important because hypertension, diabetes, dyslipidaemia, obesity, cardiovascular disease and their complications can contribute to disability, renal disease, visual impairment, cognitive decline and loss of independence. The Institute for Public Health has highlighted high blood pressure, high cholesterol, diabetes and depression among concerns affecting older Malaysians (Institute for Public Health, 2025). These

conditions interact with social factors such as income, education, food environments, physical activity opportunities and access to continuous primary care.

A longevity-oriented public health model would therefore begin decades before old age. Healthy ageing is accumulated. Tobacco avoidance, appropriate nutrition, physical activity, healthy body composition, adequate sleep, vaccination, oral health, mental wellbeing and management of metabolic risk can influence later-life function. This life-course perspective prevents longevity from being reduced to interventions targeted only at people who are already old.

The healthspan concept also encourages outcomes beyond mortality. Public health surveillance can pay greater attention to disability-free life expectancy, frailty, falls, mobility, cognition, social isolation, self-rated health and ability to perform daily activities. Such indicators make it possible to ask whether longer survival is accompanied by maintained function. They can also expose inequalities hidden by national averages.

A further challenge is multimorbidity. Traditional services often organise care by disease, whereas older adults may simultaneously experience diabetes, hypertension, osteoarthritis, sensory impairment and mental-health concerns. Polypharmacy and repeated specialist appointments can increase treatment burden. Integrated primary care, medication review, rehabilitation, nutrition support and coordinated referral become increasingly important. In this respect, healthy ageing is as much a health-system design problem as a biomedical problem.

7. Health-System Readiness, Community Support and Long-Term Care

Long-term care is one of the clearest areas where demographic change becomes a system-level challenge. The candidate's doctoral work identifies pressure on elderly-care facilities, preference for family caregiving, the existence of unregistered facilities and the need for stronger preventive infrastructure and public education. These observations point to a continuum of care rather than a binary choice between independent living and institutional care.

Most people wish to remain in their homes and communities for as long as possible. Supporting this preference requires accessible primary care, home-based services, caregiver training, rehabilitation, assistive technologies, respite support, safe housing and community networks. When institutional care becomes necessary, quality standards, workforce competence, safeguarding and regulatory oversight become essential.

The Thirteenth Malaysia Plan identifies establishment of a sustainable long-term-care ecosystem as part of preparation for an aged nation (Ministry of Economy Malaysia, 2025). This is significant because long-term care cannot be solved by hospitals alone. Acute hospitals are designed for diagnosis and treatment of episodes of illness, not for prolonged support with daily living. Without community and long-term-care capacity, families may experience high caregiving burden and hospitals may face avoidable admissions or delayed discharge.

Workforce planning is equally important. An ageing society needs sufficient geriatric expertise, nurses, allied health professionals, rehabilitation staff, community health workers and trained caregivers. It also needs health professionals outside geriatric specialties to understand ageing, frailty, communication, polypharmacy and functional assessment. Public health planning should anticipate these workforce needs before demand peaks.

Community support is a protective health resource. Social isolation and loneliness can worsen wellbeing, while opportunities for participation, volunteering, lifelong learning and intergenerational activity can support purpose and connection. Malaysia's National Policy for Older Persons explicitly recognises lifelong learning and intergenerational engagement. This demonstrates why healthy ageing cannot be delivered solely through clinics: municipalities, community organisations, families, educational institutions and civil society all influence functional ageing.

8. Prevention as the Core of Public Health Longevity

Prevention is the strongest bridge between conventional public health and longevity science. At its most defensible, longevity science asks how disease and functional decline can be delayed, detected earlier or prevented. This is already central to public health. The opportunity is to combine established population interventions with more precise risk stratification where evidence supports it.

Primary prevention includes environments and behaviours that reduce disease risk before illness develops. Secondary prevention includes appropriate screening and early detection. Tertiary prevention seeks to reduce complications and preserve function among people who already have disease. Healthy ageing requires all three. For example, physical activity can contribute to cardiovascular health, metabolic control, muscle strength, balance and mental wellbeing; yet people with established disease may require tailored exercise and rehabilitation rather than generic advice.

Health literacy is crucial. The expansion of online health information has made sophisticated biomedical claims available directly to consumers, but the quality of that information varies widely. Older adults and families may encounter claims concerning supplements, biological-age testing, stem cells, exosomes, hormones or other interventions. Public health agencies therefore need communication strategies that neither dismiss innovation nor overstate uncertain benefits. Risk communication should explain levels of evidence, approved indications, uncertainty, possible harms and financial costs in language that the public can understand.

Preventive medicine must also remain accessible. A sophisticated healthspan strategy will fail if basic screening, medication adherence, vaccination, nutrition and physical activity support do not reach lower-income, rural or socially isolated populations. The principle should be progressive innovation: strengthen high-impact universal measures while evaluating additional technologies for groups in whom they add demonstrable value.

The candidate's doctoral work also highlights inflammation, gut health, sleep, hormones and epigenetics as areas discussed within contemporary longevity discourse. These topics vary considerably in the maturity of their evidence and clinical application. For public health purposes, they should be translated cautiously. Sleep quality, diet and metabolic health are clearly relevant to prevention; epigenetic and other biomarkers may become useful for research and risk assessment, but their routine use should depend on validation, clinical utility and cost-effectiveness. This hierarchy prevents a scientifically interesting mechanism from being mistaken for an established screening programme.

9. Technology, Geroscience and Responsible Innovation

Digital technologies may become important tools for healthy ageing. Remote monitoring, telehealth, wearable sensors, electronic health records, decision support and artificial intelligence can potentially improve continuity of care and identify changes in health earlier. For older adults with mobility limitations, remote services may reduce travel burden. For caregivers, monitoring technologies may offer reassurance. For health systems, better data integration may support population risk stratification and resource planning.

Nevertheless, technological integration creates new risks. Digital exclusion can disadvantage people with low digital literacy, limited connectivity, sensory impairment or financial constraints. Continuous monitoring can generate false alarms, anxiety and large volumes of data without clear clinical pathways. Artificial intelligence may reproduce biases in the data on which

it is trained. Personal health data also require strong privacy, consent and cybersecurity protections.

The correct public health question is therefore not whether Malaysia should use technology for healthy ageing, but which technologies should be used, for whom, under what evidence standards and with what safeguards. Technology assessment should consider clinical benefit, usability, interoperability, cost, accessibility and effects on inequalities.

Longevity science also includes rapidly developing biomedical technologies. Geroscience research, cellular therapies, gene-based approaches and regenerative medicine may eventually influence prevention or treatment of age-related conditions. Dr. Chen's professional background in clinical trials, medical affairs and regenerative medicine provides relevant subject-matter experience for examining these developments, but a public health paper must maintain a clear distinction between professional familiarity and evidence of population benefit.

Malaysia has regulatory structures for medicines, medical products and cell and gene therapy products. Emerging interventions should remain within appropriate regulatory and ethical pathways. The public health priority is to encourage legitimate research while protecting patients from misleading claims, inappropriate use and financial exploitation. Responsible innovation requires post-market surveillance, transparent reporting of adverse events, research ethics, clear indication of experimental status and communication that supports informed decision-making.

This is also an area where academic research can contribute. Malaysia can develop locally relevant evidence on ageing biomarkers, digital interventions, prevention pathways and service models. Local research is important because effectiveness, affordability and acceptability may differ across populations and health systems. Innovation should therefore be connected to universities, health services, regulators and public health institutions rather than developing solely through consumer markets.

10. Equity, Ethics and the Social Distribution of Healthy Longevity

Equity is a central test of any longevity agenda. If longer healthy lives become disproportionately available to those who can afford private diagnostics, personalised programmes and expensive interventions, longevity science could deepen existing health inequalities. The candidate's doctoral work explicitly recognises the risk that longevity science

may benefit wealthy populations first. This concern should be treated as a core policy issue rather than a secondary ethical consideration.

Health inequalities accumulate across the life course. People exposed to lower income, hazardous work, poorer housing, limited healthcare access or lower educational opportunity may enter older age with greater disease burden. A policy that begins intervention only in late life may therefore arrive after decades of unequal exposure. Healthy-ageing policy should combine universal measures with proportionate support for populations experiencing greater disadvantage.

Geography also matters. Urban centres may attract specialist services and digital infrastructure while rural communities face workforce and access constraints. Digital health can reduce distance but only where connectivity, devices, literacy and follow-up services exist. Similarly, community-based programmes must be culturally and linguistically appropriate for Malaysia's diverse population.

Gender and caregiving deserve attention. Informal caregiving is often provided by family members, and the economic and emotional consequences can be substantial. Long-term-care policy should recognise caregivers as part of the care system and consider training, respite, social protection and flexible employment arrangements.

Equity also requires financial protection. Preventive services that reduce later disease burden may be cost-saving in some circumstances, but many longevity services are paid out-of-pocket. Public financing decisions should prioritise interventions with credible evidence of population benefit. Health technology assessment can help distinguish innovations that offer meaningful value from those that primarily add cost.

Finally, dignity must remain central. Healthy ageing should not imply that illness or disability represents personal failure. Nor should longevity become a moral obligation to pursue every possible intervention. Public health should support informed choice, independence and participation while respecting different preferences about ageing and care.

11. Governance and Policy Integration

Malaysia does not need to build a healthy-ageing strategy from zero. Existing policies provide a foundation, but longevity science introduces questions that cut across conventional administrative boundaries. An integrated governance model should connect ageing policy,

primary care, non-communicable disease prevention, long-term care, digital health, research, biotechnology regulation and social protection.

The first governance principle is healthspan orientation. Policies should be judged by whether they improve years lived in good health, functional ability and wellbeing, not simply whether they extend survival. This encourages meaningful outcome measurement.

The second principle is evidence proportionality. Established interventions can be implemented at scale when benefits and risks are sufficiently understood. Emerging interventions should proceed through research, evaluation and regulated clinical pathways. The burden of evidence should increase with invasiveness, cost and uncertainty.

The third principle is equity by design. New programmes should assess who can access them and whether they widen or narrow disparities. Equity impact assessment can be incorporated into technology and programme evaluation.

The fourth principle is integration. Healthy ageing should be embedded across the life course and across sectors. Primary care can coordinate risk management; hospitals can strengthen geriatric-sensitive pathways; community organisations can support participation; social services can address care needs; and digital systems can improve continuity where appropriate.

The fifth principle is public trust. Longevity is a field in which hope, commercial claims and scientific uncertainty can intersect. Transparent communication, conflict-of-interest management, ethical oversight and enforcement against misleading health claims are therefore important.

The sixth principle is learning. Because ageing and longevity science are rapidly evolving, policy should incorporate monitoring and evaluation. Programmes can begin with pilots, collect implementation and outcome data, and scale when value is demonstrated. Universities can contribute independent evaluation and workforce development.

12. Proposed Integrated Public Health Longevity Framework for Malaysia

Based on the preceding analysis, this paper proposes an Integrated Public Health Longevity Framework for Malaysia with six mutually reinforcing domains.

Domain 1 is life-course prevention. Healthy ageing should begin before old age through prevention and control of major non-communicable disease risks, vaccination, nutrition, physical activity, mental wellbeing, sleep health and avoidance of harmful exposures.

Domain 2 is functional and person-centred ageing. Services should measure and support mobility, cognition, sensory function, psychological wellbeing and ability to perform daily activities. Clinical success should include maintained independence and quality of life.

Domain 3 is integrated care and community capacity. Primary care, hospitals, rehabilitation, home care, long-term care, caregivers and community organisations should operate as a continuum rather than isolated services. Referral pathways and information exchange are central.

Domain 4 is responsible technology and innovation. Digital monitoring, AI, biomarkers and emerging biomedical technologies should be assessed for evidence, safety, cost-effectiveness, accessibility and ethical acceptability. Experimental approaches should remain clearly identified as experimental.

Domain 5 is equity and social protection. Healthy-ageing strategies should identify groups at risk of exclusion and provide proportionate support. Financial protection, rural access, caregiver support and digital inclusion are integral public health concerns.

Domain 6 is data, research and adaptive governance. Malaysia should strengthen longitudinal evidence on functional ageing, multimorbidity, healthspan, care needs and intervention outcomes. Research should support policy decisions, and policy should be revised as evidence changes.

The framework is deliberately broader than a biomedical model of longevity. It recognises that biological ageing occurs within social environments and health systems. A breakthrough therapy cannot compensate for inaccessible primary care, unsafe housing, poverty or social isolation. Conversely, social policy alone cannot replace effective prevention and treatment. Healthy longevity emerges from the interaction of these domains.

For doctoral research, the framework also provides a basis for further empirical investigation. Soft Systems Methodology, which is central to the candidate's wider doctoral project, could be used to examine how stakeholders define the problem of longevity and ageing differently, where institutional tensions occur, and which feasible system changes are culturally and organisationally acceptable. Potential stakeholders include older persons, caregivers, clinicians, public health professionals, regulators, policymakers, researchers, private providers and civil society organisations. Such work could move the conceptual framework towards a Malaysia-specific policy model.

13. Discussion

The analysis suggests that the most productive way to position longevity science within public health is to redefine its objective. The objective should not be maximum lifespan at any cost. It should be compression or postponement of preventable morbidity, preservation of functional ability and fair distribution of healthy years. This framing reduces the apparent tension between conventional healthy ageing and newer longevity science.

Malaysia's existing ageing policies already contain many elements needed for such an approach. The challenge is coordination and implementation. National ageing policy emphasises dignity, participation and shared responsibility, while newer planning frameworks recognise long-term care and ageing preparedness. Longevity science can add value by strengthening attention to healthspan, earlier prevention, risk stratification, biological mechanisms and responsible innovation. It should not displace the social determinants of health or the basic services on which population health depends.

A major strength of the healthspan concept is that it can connect individual aspirations with system objectives. Individuals generally want to remain mobile, cognitively capable and independent. Health systems want to reduce avoidable disease and high-cost dependency. Governments want sustainable participation and manageable care needs. Healthspan provides a common language across these interests.

However, measurement remains challenging. There is no single universally accepted clinical measure of healthspan. Population indicators such as healthy life expectancy provide one perspective, while functional measures, frailty indices, disease-free survival and patient-reported outcomes provide others. Malaysia would benefit from a coherent set of indicators that can be monitored over time and disaggregated by socioeconomic group, sex, geography and other relevant factors.

Another important issue is the relationship between innovation and evidence. Longevity science attracts interest precisely because it promises to move beyond reactive disease treatment. Yet prevention itself requires evidence. Public health has a responsibility to distinguish promising hypotheses from validated interventions. This does not require hostility towards innovation. On the contrary, clear research pathways and regulatory expectations can support credible innovation by separating it from unsupported claims.

The same principle applies to regenerative medicine. The candidate's broader work explores stem cells and other regenerative approaches in considerable detail. For this first paper, these

technologies are best treated as part of the future innovation landscape rather than as the foundation of healthy-ageing policy. Paper 2 can examine regenerative medicine more specifically. This separation gives the two papers distinct scholarly purposes and prevents unnecessary duplication.

The timing is particularly relevant. Malaysia is entering a period in which ageing policy will receive increasing attention. Decisions made now about primary care, long-term care, workforce, digital systems and social protection will shape the experience of ageing for decades. A healthspan perspective can help ensure that policy does not wait until people become dependent before acting.

The proposed framework also supports a shift from sector-specific responses to systems thinking. Ageing is a complex problem because interventions in one part of the system affect others. Better prevention may reduce later care demand; better home support may reduce hospital use; improved caregiver support may delay institutionalisation; digital monitoring may help some patients but create new inequities for others. Systems approaches are therefore appropriate for identifying trade-offs and unintended consequences.

Finally, the public conversation around ageing matters. An ageing society should not be portrayed solely as an economic burden. Older adults contribute through employment, caregiving, volunteering, mentoring, consumption, family support and community knowledge. Healthy-ageing policy should preserve opportunities for contribution. This aligns with Malaysia's policy emphasis on older persons as active participants in national development rather than passive recipients of care.

14. Implications for Public Health Policy and Practice

Several policy implications follow. First, healthspan should become an explicit organising concept within healthy-ageing evaluation. National targets can include functional and disability-related outcomes alongside life expectancy and disease indicators.

Second, prevention should be intensified through primary care and community platforms. Risk-factor management in middle age is a longevity intervention in the most practical public health sense. Programmes should therefore connect healthy-ageing goals with non-communicable disease prevention rather than creating parallel systems.

Third, long-term care development should proceed as a coordinated ecosystem. Standards, financing, workforce development, caregiver support, home-based care and institutional services should be planned together.

Fourth, Malaysia should develop a transparent assessment pathway for longevity-related technologies. Such a pathway could consider scientific validity, clinical utility, safety, cost-effectiveness, ethical implications, data protection and equity. Public-facing communication should clearly distinguish established care, approved indications, research use and experimental services.

Fifth, research investment should include both biomedical and implementation science. Biological research is important, but so are studies of service delivery, behaviour, community support, financing, caregiver burden and technology adoption. A balanced portfolio is more likely to produce population benefit.

Sixth, older persons should be involved in policy design. Healthy ageing cannot be adequately defined only by professionals. Preferences concerning independence, acceptable risk, technology, family support and end-of-life priorities vary. Participatory approaches can make policies more responsive and legitimate.

Seventh, Malaysia should strengthen public and professional literacy concerning longevity science. Clinicians and public health practitioners need enough knowledge to discuss emerging technologies critically, while the public needs accessible information to evaluate commercial claims. Universities and professional bodies can play an important role in this translation function.

15. Limitations and Future Research

This paper has several limitations. It is a narrative and policy-oriented review rather than a systematic review or meta-analysis. The selection and synthesis of literature are therefore interpretive and should not be understood as an exhaustive assessment of all longevity interventions. Second, the paper does not contain primary Malaysian participant data and cannot quantify stakeholder preferences or causal effects. Third, longevity science is evolving rapidly, meaning that evidence and regulatory positions may change. Fourth, healthspan itself can be operationalised in different ways, and no single measure captures all dimensions of healthy ageing.

These limitations define priorities for subsequent research. A systematic scoping review could map longevity-related interventions and policy approaches in Southeast Asia. Qualitative stakeholder research could examine how Malaysian policymakers, clinicians, older adults and industry actors understand longevity science. Soft Systems Methodology could explore conflicting perspectives and feasible system reforms. Longitudinal studies could evaluate healthspan indicators and inequalities. Economic evaluation could identify which preventive and technological interventions provide value within Malaysia's health system.

16. Conclusion

Malaysia's transition towards an ageing society is both a public health challenge and an opportunity to redesign health policy around longer, healthier and more functional lives. Longevity science can contribute to this agenda, but only if it is positioned carefully. Its public value lies less in the pursuit of extreme lifespan extension than in its potential to reinforce prevention, improve understanding of age-related risk, support earlier intervention and stimulate responsible innovation.

The central policy objective should be healthspan. Longer life is most meaningful when people retain physical and cognitive function, independence, social participation and dignity. Achieving this requires action across the life course and across sectors: prevention of non-communicable disease, integrated primary and community care, sustainable long-term care, caregiver support, age-friendly environments, digital inclusion, research and effective governance.

Emerging technologies should be welcomed as research opportunities but evaluated with the same standards expected of other health interventions. Evidence, safety, affordability, ethics and equity must determine their place in public health. Malaysia should avoid a two-tier longevity future in which advanced preventive opportunities are available only to affluent groups while basic healthy-ageing needs remain unmet.

An integrated public health longevity framework offers a way forward. By combining life-course prevention, functional ageing, coordinated care, responsible innovation, equity and adaptive governance, Malaysia can connect established healthy-ageing policy with the most useful elements of longevity science. The success of this agenda should ultimately be measured not by how many years are added to life, but by how many of those years are lived with health, capability, connection and purpose.

References

- Abud, T., Kounidas, G., Martin, K. R., Werth, M., Cooper, K., & Myint, P. K. (2022). Determinants of healthy ageing: A systematic review of contemporary literature. *Aging Clinical and Experimental Research*, 34, 1215–1223.
- Beard, J. R., Officer, A., de Carvalho, I. A., Sadana, R., Pot, A. M., Michel, J.-P., Lloyd-Sherlock, P., Epping-Jordan, J. E., Peeters, G. M. E. E., Mahanani, W. R., Thiyagarajan, J. A., & Chatterji, S. (2016). The World report on ageing and health: A policy framework for healthy ageing. *The Lancet*, 387(10033), 2145–2154.
- Department of Statistics Malaysia. (2024). Population projections (revised), Malaysia, 2010–2040. Department of Statistics Malaysia.
- Government of Malaysia. (2026a). Definition of the elderly. Malaysia.gov.my.
- Government of Malaysia. (2026b). National Policy for Senior Citizens. Malaysia.gov.my.
- Institute for Public Health. (2025). National Health and Morbidity Survey 2025: Ageing nation—key information and survey programme. Ministry of Health Malaysia.
- Kennedy, B. K., Berger, S. L., Brunet, A., Campisi, J., Cuervo, A. M., Epel, E. S., Franceschi, C., Lithgow, G. J., Morimoto, R. I., Pessin, J. E., Rando, T. A., Richardson, A., Schadt, E. E., Wyss-Coray, T., & Sierra, F. (2014). Geroscience: Linking aging to chronic disease. *Cell*, 159(4), 709–713.
- López-Otín, C., Blasco, M. A., Partridge, L., Serrano, M., & Kroemer, G. (2013). The hallmarks of aging. *Cell*, 153(6), 1194–1217.
- López-Otín, C., Blasco, M. A., Partridge, L., Serrano, M., & Kroemer, G. (2023). Hallmarks of aging: An expanding universe. *Cell*, 186(2), 243–278.
- Ministry of Economy Malaysia. (2025). Thirteenth Malaysia Plan, 2026–2030. Government of Malaysia.
- Ministry of Health Malaysia. (2008). National Health Policy for Older Persons. Ministry of Health Malaysia.
- Olshansky, S. J. (2018). From lifespan to healthspan. *JAMA*, 320(13), 1323–1324.
- United Nations. (2020). World Population Ageing 2020 Highlights. United Nations Department of Economic and Social Affairs.

- United Nations Development Programme Malaysia. (2024). Navigating the future of care for older persons in Malaysia by 2040: Community support and technological integration. UNDP Malaysia.
- World Health Organization. (2015). World report on ageing and health. World Health Organization.
- World Health Organization. (2020). Decade of Healthy Ageing: Baseline report. World Health Organization.
- World Health Organization. (2021). Decade of Healthy Ageing 2021–2030. World Health Organization.
- World Health Organization. (2022). Ageing and health. World Health Organization.
- World Health Organization Regional Office for South-East Asia. (2025). WHO South-East Asia Regional Strategy on Healthy Ageing 2024–2030. World Health Organization.