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Policy Report

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The longevity dividend

Advancing health promotion across the life course

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FOREWORD

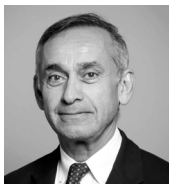
Gains in life expectancy have outpaced improvements in healthy life expectancy in many countries.[1] This divergence establishes a policy priority: improving health, reducing avoidable morbidity and functional limitations while sustaining wellbeing and participation across the life course.[2,3]

The opportunity of a national healthy longevity strategy is to integrate health promotion, prevention, clinical care and social support from early development through later life, with explicit provision for people living with chronic disease or disability. Established population health interventions and accessible preventive care form the basis of implementation. Priorities include healthy environments, physical activity, nutrition, sleep and stress management and identification and management of established risk factors.[3,4]

Healthy longevity medicine, academically termed 'precision geromedicine', could eventually contribute to a longer healthy life. It would do this through co-ordinated clinical care aiming to optimize health and healthspan by applying advances in geroscience to individual assessment and intervention. All applications require evidence of validity, clinical benefit and safety for their intended use.[5,6] Next to sustaining effective services, public investment should support research that can establish the additional benefit of emerging geromedicine approaches.

This report synthesizes scientific evidence, institutional policy frameworks and expert contributions to inform a national healthy longevity policy. It identifies priorities for implementation, requirements for evaluating emerging assessments and interventions, and options for governance, financing, workforce development and accountability.

For Qatar, the proposed policy framework for healthy longevity co-ordinates existing programs within the national health policy context. Equitable access and the distribution of health outcomes are explicit criteria for priority setting, resource allocation and evaluation.



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EXECUTIVE SUMMARY

POLICY RATIONALE AND STRATEGIC OBJECTIVE

The world's population of people aged 60 years or over will rise from 1 billion in 2020 to 1.4 billion by 2030 and 2.1 billion by 2050,[14] with life expectancy also increasing.[1] But will those extra years be *healthy* years?

This report focuses on healthy longevity. It examines the latest research on emerging precision geromedicine[5] and proposes a framework to improve health, preserve functional ability and support equitable participation across the life course. Education, income, housing, employment and access to care are relevant determinants of healthy longevity.[2,3] We need better co-ordination between existing health, social, education, research and community programs, with defined responsibilities for reducing avoidable disease and functional decline.

IMPLEMENTATION PRIORITIES AND EVALUATION REQUIREMENTS

A key priority is to strengthen existing health interventions/programs. These include: healthy early development; initiatives in schools and workplaces that support healthy behavior and education; tobacco control; access to nutritious food; enabling physical activity; sleep and stress management; preventive care; and effective management of disease.[4,7,8] For people with a disability or declining function, accessible rehabilitation, assistive products, social support and co-ordinated care are needed.[9] Service selection should be informed by population need, effectiveness, equity and available resources.

THE LONGEVITY DIVIDEND

Longer lives in better health can support employment, unpaid care and participation in family and community life.[3] The International Monetary Fund (IMF) estimates that further improvements in health could add about 0.4 percentage points to average annual global gross domestic product (GDP) growth during 2025–2050 through increased labor supply and human capital.[10] For national planning, this projection supports joint consideration of health, employment and education policy.

EQUITY AND ACCESS

Implementation resources should prioritize accessible, effective services and the social and environmental conditions that support health.[3] Program design and evaluation should explicitly include people with lifelong disabilities and acquired functional limitations,[9] and people with low income or barriers to care.[11]

DEFINITIONS

In this report, 'healthy longevity medicine' refers to clinical care that aims to improve and support health and function across life. The academic term is 'precision geromedicine', which describes the emerging practice of applying the biology of

aging to individual assessment and clinical intervention. Its contribution should be evaluated alongside established care, using prespecified clinical outcomes, costs and measures of equitable access.[5,6] (The Glossary provides more information and defines the technical terms used in the scientific sections.)

WHAT THIS REPORT COVERS

This report proposes a policy framework for healthy longevity with three main principles: (i) health promotion across the life course;[2] (ii) implementation of established prevention, clinical care and functional support; and (iii) co-ordination across health, education, employment, finance, social protection and the built environment – guided by equitable access and health outcomes as an overarching theme.

- **Section 1** of the report introduces the context for healthy longevity and examines the latest research in this area.
- **Section 2** examines the framework's first principle: health promotion across the life course.
- **Section 3** focuses on the second principle in the proposed policy framework: implementation and expansion of established prevention, clinical care and functional support. It examines how established general healthcare programs for separate health issues could combine with emerging geroscience to improve clinical outcomes for healthy longevity.
- **Section 4** focuses on the third principle in the proposed policy framework: co-ordination across health, education, employment, finance, social protection and the built environment. It looks at current examples from Singapore, Japan, the UK, Ethiopia, Rwanda and Sardinia, and how Qatar could implement some of the successful health measures.
- **Section 5** proposes eight priority recommendations for national policy, covering population health, service delivery, evaluation and research governance:

    1. Make health promotion across the life course a shared national objective.
    2. Connect social policy equity and disability inclusion.
    3. Strengthen integrated healthy longevity care.
    4. Establish data and monitoring as national infrastructure.
    5. Develop competence and public understanding.
    6. Co-ordinate research and evidence pathways.
    7. Clarify standards and regulatory responsibilities.
    8. Fund phased implementation and independent evaluation.

For Qatar, the proposed sequence aligns with the National Health Strategy 2024–2030: agree governance, baseline and a costed roadmap in 2026–2027; implement and evaluate selected priorities in 2027–2028; integrate successful approaches into routine systems by 2030; and sustain effective services thereafter.

SECTION 1. INTRODUCTION

LIFE EXPECTANCY VS. HEALTHY LIFE EXPECTANCY

Between 2000 and 2019, global life expectancy increased by 6.5 years, while healthy life expectancy increased by 5.4 years, according to analyses of World Health Organization (WHO) data covering 183 Member States.[1]

Healthy life expectancy takes into account the prevalence and severity of health problems across ages, expressing expected length of life in equivalent years of full health.[12] A separate analysis of the Global Burden of Disease Study 2023 covered 204 countries and territories. Between 1990 and 2023, the global gap between life expectancy and healthy life expectancy increased from 8.8 years (95 percent uncertainty interval 6.7–11.2) to 10.7 years (8.2–13.7).[13] Health loss extended across the adult life, rather than being confined to the final years of life. Musculoskeletal and mental disorders, hearing loss and falls were important contributors.[13] These findings support explicit inclusion of health and functional outcomes in policy planning across the life course.

ARE HEALTH SYSTEMS PREPARED FOR DEMOGRAPHIC CHANGES?

WHO projects that the number of people aged 60 years or over will increase from 1 billion in 2020 to 1.4 billion by 2030 and 2.1 billion by 2050.[14] Preparing for this demographic change requires investment in health throughout the life course.[3] The National Academy of Medicine's Global Roadmap for Healthy Longevity identifies health systems, social infrastructure and supportive physical environments as foundations for longer lives in good health.[3] Investments in these areas can strengthen opportunities for physical activity, social participation and access to care, with priorities adapted to national resources and inequalities.[3]

NEW DEVELOPMENTS IN GEROMEDICINE

Adding to this health focus are advances in the biology of aging and the development of healthy longevity medicine – or precision geromedicine – which are informing the development and clinical evaluation of diagnostics and interventions aimed at preserving health, function, independence and quality of life throughout the life course.[5] Translating these advances into practice requires appropriate research infrastructure, skilled professionals, longitudinal data and robust assessment of effectiveness, safety, equity and suitability across populations.[5,6]

This report's proposed policy response combines implementation of established health interventions with the research and regulatory capacity required to evaluate the new emerging geromedicine approaches before wider adoption. Therefore, future investment can focus on strengthening established health promotion approaches while building the capacity to evaluate and responsibly integrate emerging interventions as evidence evolves.

ECONOMIC IMPLICATIONS AND DISTRIBUTION OF BENEFITS

The economic relevance of healthy longevity extends beyond healthcare expenditure to participation in employment, unpaid care and community life.[3] Economic models also place a value on improved health and survival. Scott and colleagues estimated that a hypothetical slowing of aging that increases US life expectancy by one year would be worth $38 trillion.[15] This is a modeled valuation of health and survival gains across generations, not an amount available to a government or an estimate of savings. National investment decisions instead require program-specific estimates of effectiveness, cost, affordability and the equitable distribution of benefits; equal access to healthy environments and care should inform those decisions.[11]

SCOPE AND SETTINGS

This report addresses healthy longevity across the life course: preconception and parental health; childhood;[7] adolescence;[8] adulthood and later life.[2] Health promotion provides the overarching framework, encompassing public policy, supportive environments and services.[3,19] The report considers three complementary delivery domains: population policy and healthy environments; consumer and wellness products or services; and medical care.*

Population policy and healthy environments: Qatar's National Health Strategy 2024–2030 provides the foundation for a healthy longevity policy.[16] The Ministry of Public Health (MoPH) leads health sector co-ordination, while education, municipalities, labor, sport, social development, finance and digital authorities retain their respective responsibilities. Ministries and municipalities shape food, tobacco, transport, education, work, housing, accessibility and social protection.[19] Population measures are selected for their health effects and distribution of benefit and are evaluated alongside individual services.[3,4]

Consumer and wellness products and services: In Qatar, the Ministry of Commerce and Industry (MoCI) oversees consumer protection,[20] MoPH provides registration of relevant health products,[21] and the Department of Healthcare Professions (DHP) sets healthcare-practitioner advertising requirements.[22] Consumers' healthy behaviors can be supported by self-directed information, products and monitoring, together with exercise, nutrition, sleep and wellbeing services. In the field of consumer and wellness products and services, product sellers should substantiate product claims. Service providers should specify staff competence, program evidence, accessibility and referral criteria. There must be applicable medical oversight for all clinical claims or procedures.

Medical care: Qualified professionals provide clinical assessment, advice and treatment to enable prevention and rehabilitation with appropriate follow-up, integrated with existing care.[23] WHO's Integrated Care for Older People (ICOPE) pathway informs assessment and follow-up in older adults.[24] Healthy longevity medicine encompasses this broad clinical contribution. Precision geromedicine combines gerodiagnostics and individualized interventions to optimize health and address aging-related vulnerability, with the additional value of each application

* These operational categories are used for this report. Qatar's requirements for products, professional practice, consumer protection and data remain applicable.[20–22]

evaluated against established care.[5,6] Providers should identify the clinician responsible for interpretation, prescribing, referral and adverse-event follow-up, within the applicable product and professional requirements.[21,22]

RESEARCH APPROACH AND EVIDENCE INTERPRETATION

This report is a narrative scientific and policy synthesis. It draws on published peer-reviewed literature, official national data, regulatory documents, institutional policy frameworks and policy reports. International experts were consulted in a group meeting and individual sessions recorded between June and July 2026. These consultations informed policy priorities, and published sources support empirical claims.

Throughout the report, a series of tables provide detailed information to support the analysis:

- **Table 1** highlights current health assessment choices, supporting evidence and limits.
- **Table 2** presents examples of interventions designed to encourage healthy longevity, including those that have unsupported or unfavorable outcomes.
- **Table 3** focuses on health programs in Qatar that could be used as foundations for delivering healthy longevity.
- **Table 4** shows possible measurements, sources of evidence and proposed accountability reporting.
- **Table 5** translates the report's eight recommendations into a proposed implementation matrix, listing who should be responsible for each milestone.

Published certainty ratings are labeled as source-rated. Other grades are provisional narrative appraisals considering bias, consistency, precision and applicability.[17] For assessments, accuracy and prediction are distinguished from benefit from test-guided care.[18] Unevaluated delivery arrangements are labeled as proposals. This narrative review does not constitute a systematic search or formal Grading of Recommendations Assessment, Development and Evaluation (GRADE) assessment. The emerging precision geromedicine is addressed through research and evaluation.[5]

SECTION 2. THE CASE FOR PROMOTING HEALTHY LONGEVITY ACROSS THE LIFE COURSE

This report proposes a policy framework for healthy longevity. This section examines the framework's first principle: health promotion across the life course. It examines how healthy longevity is currently promoted across the life course through established health interventions that support physical and mental health – from foundations in newborn and childhood health to adolescence and transition to adult services – such as nutrition initiatives, and exercise to support cardiovascular, cognitive and mental health. The section makes the case for investing in healthy longevity – from public research to commercial development – including recent research projects that investigate funding options. It also examines how pension and employment policy can support changing health opportunities.

An overarching theme of this report's proposed policy framework for healthy longevity is equitable access and outcomes across the population. Therefore, this section also looks at how access to the benefits of healthy longevity are distributed unequally across socioeconomic and age groups, and for people with disabilities.

2.1 HEALTH PROMOTION FROM EARLY LIFE ONWARDS

Health promotion includes individual and community health, together with its social, economic and environmental determinants.[19] Applied to healthy longevity, the objectives of health promotion include the development and maintenance of physical, cognitive, psychological and social capacities across the life course.[2,3] Achieving these objectives relies on public policy, accessible services and informed individual participation.[3,19] Evaluation of success should therefore consider functional ability, wellbeing and participation alongside reductions in disease and premature mortality.[3,19] To address the range of determinants of sustained health, national policy should co-ordinate prevention and clinical care with education, employment, housing and environmental policy.[3,19]

A policy framework across the life-course would enable existing and established health interventions to be organized around age-specific needs and long-term health outcomes. For example, the World Health Organization (WHO) identifies cost-effective measures in tobacco and alcohol control, diet, physical activity and cardiovascular prevention.[4] The 2024 Lancet Commission report on dementia sets out potentially modifiable health risks spanning education, hearing loss, hypertension and high low-density lipoprotein cholesterol.[30] The contribution of these measures to healthy longevity should be assessed through the health and functional outcomes they can support, with programs adapted to local needs.[2,3]

Existing research points to some areas of life-course health that could be useful starting points for promoting healthy longevity. The subsections that follow consider how population policy, individual support and medical care can be organized around the desired health and functional outcomes.

Early-life foundations

Preconception and prenatal health are relevant to a life-course healthy longevity strategy. The Lancet preconception series reviews parental nutrition, body composition, metabolic health and exposures across low-, middle- and high-income settings.[31] Its companion review considers developmental influences around conception, distinguishing human observational from experimental animal evidence. The review calls for new guidance on preconception parental preparation for pregnancy to protect the health of offspring.[32] WHO's preconception framework addresses the health of women and men before pregnancy, including nutrition, chronic disease and harmful exposures.[33] Randomized evidence shows that periconceptional folic acid reduces recurrent neural tube defects in women with a previous affected pregnancy.[34] In a UK birth cohort, maternal antenatal depressive symptoms were associated with offspring depression at age 18 years; however, this observational association does not establish that treating the mother prevents that outcome.[35] In the early life stages after birth, WHO's nurturing care framework connects health and nutrition with responsive caregiving, safety and early learning.[7]

Parental health

Primary care and reproductive health services can provide management of chronic conditions, appropriate nutrition, tobacco and alcohol risk reduction, medication review and informed reproductive choices.[33] These health services should reach prospective parents before pregnancy, including those people who may conceive without a planned pregnancy. Service delivery should involve partners and, as appropriate, other caregivers, with support adapted to family circumstances. Support during pregnancy and early childhood also includes maternal mental health care, infant feeding advice, responsive caregiving and opportunities for early learning.[7]

Maternal and newborn health

Quality antenatal, childbirth and postnatal services should connect maternal physical and mental health with infant feeding, growth and development. WHO antenatal guidance provides a framework for nutrition, maternal and fetal assessment, prevention and person-centered care.[36] Referral and follow-up should remain continuous when pregnancy-related risks indicate later needs for cardiovascular, metabolic or mental-health care.

Childhood and school health

Responsive caregiving and learning opportunities are central to nurturing care provision.[7] Schools provide a practical setting for health promotion, with inclusive facilities and support for children with disabilities.[9,37] Primary care, early years services and education should co-ordinate developmental support, vaccination, nutrition, oral and sensory health, physical activity, safe environments and early identification of health issues.

Adolescence and transition to adult services

Priorities in the transition from adolescent to adult health services include mental and sexual health, nutrition, physical activity, tobacco and substance-use prevention, injury prevention and health literacy, selected against national burden. WHO's Global Accelerated Action for the Health of Adolescents (AA-HA!) guidance provides a planning and implementation framework.[8] Program design should include structured consultation with young people. Adolescents with chronic conditions or lifelong disabilities need a named transition plan, continuity of interventions including rehabilitation, and access to education and social support.[9]



Priorities in the transition from adolescent to adult health services include mental and sexual health, nutrition, physical activity, tobacco and substance-use prevention, injury prevention and health literacy.

In Qatar, the MoPH, Primary Health Care Corporation (PHCC) and Hamad Medical Corporation (HMC) could work with education, social-development and municipal partners to map existing maternal, child, school and adolescent services. Co-ordinated referral and follow-up arrangements could integrate early-life services within the proposed national healthy longevity strategy.

The first actions should be to identify gaps in access, link referral arrangements and agree transitions into adult care, with age-appropriate measures such as developmental follow-up, school participation and completed referrals. The National Health Strategy's roadmap for 2026–2030 provides a planning horizon for these proposals, although the priorities, responsibilities and costs require national agreement. The National Health Strategy[16] and HMC Healthcare Strategy[38] provide existing planning models.

2.2 EXISTING HEALTH PROGRAMS TO SUPPORT HEALTHY LONGEVITY

Established population interventions support healthy longevity through improvements in health, disease prevention and the maintenance of function. The following examples illustrate a portfolio that combines supportive environments with accessible individual care.[3,4]

Tobacco control

Smoke-free legislation, taxation, cessation support and restrictions on tobacco marketing are established public health measures.[4] A meta-analysis of 10 studies found that smoke-free legislation was associated with 8 percent lower mortality from acute myocardial infarction (relative risk 0.92; 95 percent confidence interval 0.90–0.94).[40] These findings support comprehensive tobacco control to reduce exposure and protect cardiovascular health.[4,40]

Healthier food environments

The UK's Soft Drinks Industry Levy illustrates how fiscal policy can encourage reformulation.[41] Twenty-two months after the levy's implementation, an interrupted time-series analysis in England estimated 12.1 percent fewer hospital admissions for carious tooth extractions among children aged 0–18 years.[42] A separate model projected 200,000 additional quality-adjusted life years and £174 million in discounted healthcare savings over the current UK population's lifetime.[43] These are modeled health gains and healthcare savings, conditional on sustained changes in consumption. Qatar could assess comparable measures based on purchasing patterns, baseline risk and implementation costs.

Healthy exercise

WHO recommends aerobic activity and muscle strengthening across adulthood, adapted to capacity and health status.[44] Singapore's National Steps Challenge combines consumer wearables, incentives and population outreach.[45] A 2026 microsimulation projected about 179,380 fewer people with obesity and 36,407 fewer with type 2 diabetes by 2050 than without the program, conditional on participation and model assumptions.[46] Qatar's National Physical Activity Guidelines provide a local model for adaptation.[48]

Cardiovascular health

Accurate blood pressure measurement, accessible treatment and sustained follow-up are established health priorities to reduce the risk of hypertension and major cardiovascular events.[4] However, a 2019 study found that only 23 percent of women and 18 percent of men aged 30–79 years with hypertension had their blood pressure controlled, and 82 percent of adults with hypertension lived in low- and middle-income countries.[50] These findings support investment in accessible primary care, essential medicines and sustained treatment appropriate to cardiovascular risk.[4,50] Qatar's *Health Brief Report 2024* revealed that 24.3 percent of adults aged 18–69 years in the 2023–2024 STEPwise survey displayed raised blood pressure or were receiving treatment for hypertension.[51] The national 2024–2030 action plan on obesity, diabetes and modifiable atherosclerotic cardiovascular risk provides an existing implementation platform.[52]

Nutrition

A 2025 prospective analysis of 105,015 adults followed for up to 30 years linked healthier dietary patterns in midlife with healthy aging at age 70 years or beyond, defined by the absence of 11 major chronic diseases and preserved cognitive, physical and mental health.[53] Across eight dietary patterns, participants in the highest fifth of adherence had 45 percent to 86 percent greater odds of healthy aging than those in the lowest fifth.[53] These observational findings complement randomized evidence from the PREDIMED study of the benefits of a Mediterranean diet.[54] In the corrected trial analysis of 7,447 adults aged 55–80 years at high cardiovascular risk, Mediterranean diets supplemented with extra-virgin olive oil or nuts were associated with 31 percent and 28 percent lower hazards, respectively, for the composite outcome of myocardial infarction, stroke or cardiovascular death

compared with advice to reduce dietary fat, over a median 4.8 years.[54] Together, these findings support making nutritious food more affordable and available and providing dietary advice suited to health and nutritional needs.[4,53,54]

Cognitive health

The 2024 Lancet Commission estimated that addressing 14 potentially modifiable factors could prevent or delay around 45 percent of dementia cases globally.[30] This population-attributable estimate combines evidence on risk-factor prevalence and associations with dementia under specified modeling assumptions.[30] It supports a life-course approach that includes education, physical activity and cardiovascular health, alongside treatment of hearing and vision loss and opportunities for social participation.[30] These measures connect cognitive health promotion with action in communities and clinical care throughout adulthood.[30]

Mental health and social connection

WHO's 2025 Commission on Social Connection estimated that around one in six people worldwide experienced loneliness, with particularly high prevalence among adolescents and young adults.[55] Healthy longevity policy should therefore support relationships and mental health throughout life. Accessible schools, workplaces and community spaces, alongside appropriate clinical services, can form part of the response. Program evaluation should distinguish participation in activities, perceived loneliness, mental health and sustained social connection.

2.3 THE LONGEVITY DIVIDEND: THE CASE FOR INVESTING IN HEALTHY LONGEVITY

Investment in healthy longevity spans public research, philanthropy and commercial development. To assess its contribution, this report proposes separate accounting for consumer products, wellness services and medical research and care, with geroscience funding identified by its scientific objective and stage of development. Each category should be evaluated against the outcomes it seeks to achieve and its expected public value. This distinction allows investment in research into aging biology and clinical translation to be assessed within the wider health-promotion agenda.[3,5]

Economic modeling can inform assessment of established prevention programs. A 2026 World Economic Forum analysis of 21 countries modeled home safety improvements, physical activity programs and access to hearing aids, projecting more than $5.8 trillion in healthcare savings and $645 billion in productivity gains by 2040.[56]

Assessing investment in health promotion requires a wider view of budgets across education, housing, transport and employment, together with the contribution of primary care.[19,39] Governments should identify these resources explicitly and evaluate their effects on health, capacity and access.[19] Within health services, sustained support depends on stronger care co-ordination, workforce capacity, information systems and payment incentives.[23] Primary care reform can therefore connect individual assessment and follow-up with the environments where people act on health advice.[23]

Funding models

Recent initiatives illustrate different funding models. XPRIZE Healthspan is a seven-year $101 million global competition to incentivize therapeutics for healthy longevity. Hevolution and SOLVE FSHD, a facioscapulohumeral muscular dystrophy initiative with sponsors, targets muscle, cognitive and immune function.[57] In the US, the Advanced Research Projects Agency for Health (ARPA-H) announced up to $144 million over five years for Proactive Solutions for Prolonging Resilience (PROSPR) research teams, through milestone-dependent contracts.[58] Singapore announced a S$350 million healthy longevity Grand Challenge under its Research, Innovation and Enterprise 2030 plan.[59]

Public, philanthropic and commercial funding can support complementary parts of the pathway towards health promotion and optimization. This report proposes that funders co-ordinate investment in biomarkers of aging, clinical trials, long-term follow-up and implementation, with transparent reporting of commitments, disbursements, conflicts of interest and results.[57,59,60]

Employment pensions and long-term financial security

Healthcare and geromedicine are evolving, and people's workplaces can provide a foundation for healthy activity. Pension and employment policies should respond together to changing health trends and opportunities for participation in healthy activities. Reviews of pensions and employment policies should assess their fiscal sustainability and the adequacy of any benefits alongside any physically demanding work, unequal health outcomes and the consequences of interrupted contribution histories.[3,63]

Flexible working, retraining, reentry and protection against age discrimination can help people stay in employment.[63] However, poor health may force some people to exit the labor market, resulting in reduced income that then constrains access to health resources. The policy proposal is to co-ordinate health, work and financial security, with protection for people unable to continue employment.

The availability of accessible formal care and support for unpaid carers influences employment, income and health, with effects assessed by sex, age and socioeconomic position. Payment arrangements should support disease prevention, continuity and co-ordination of care, with evaluation of outcomes, equity and cost.[23] The policy proposal is to review retirement products, savings, insurance and long-term care financing for their suitability to longer lives, changing health and interrupted working or caring histories.[3,63]

2.4 ETHICS EQUITY AND THE LONGEVITY DIVIDE

Health outcomes and the benefits associated with increased longevity are distributed unequally across socioeconomic groups.[3,11] For example, in England in 2022–2024, healthy life expectancy at birth based on self-reported good general health was 49.8 years for men and 48.2 years for women in the most deprived decile, compared with 69.2 and 68.5 years in the least deprived decile.[62] These estimates concern self-reported general health and are not directly comparable with WHO healthy life expectancy.[12,62] These differences support reporting (self-reported) health

outcomes by socioeconomic group alongside national averages. Measurement should distinguish life expectancy, WHO healthy life expectancy and other health expectancy measures.[12,26]

Service design for equitable access and uptake

Repeated out-of-pocket payments, time away from work, the need for travel, or the requirement to use a smartphone can create access barriers for populations with greater health needs. An umbrella review of public health policies found that some interventions that required less individual effort – welfare reform, housing support and legislation – reduced health inequalities, with effects varying across settings.[11] National programs should therefore combine accessible primary care and effective prevention with practical support for participation.[3,23]

Low- and middle-income countries and the double burden

Low- and middle-income countries face overlapping needs in infectious disease, maternal and child health, non-communicable diseases and environmental risk.[3] WHO estimates that 89 percent of premature deaths attributable to outdoor air pollution in 2019 occurred in low- and middle-income countries.[63] Accessible primary care and established interventions provide an immediate foundation: research and regulatory capacity can develop through appropriately funded partnerships.[3,23] Examples from Ethiopia and Rwanda (see Section 4) illustrate community delivery and financing, while Singapore is a high-income comparator.[25,64,65]

Age inclusion across the life course

Age-based assumptions can influence access to prevention, rehabilitation, employment and research. WHO identifies ageism as a common problem across the life course.[66] A systematic review of 422 studies from 45 countries found widespread associations between ageism and poorer health among older people.[67] Therefore, study inclusion eligibility should follow the clinical or research question, with age exclusions justified and affected groups involved in service design to avoid ageism.

Inclusive research and digital services require representative recruitment and validation in the populations intended to use them.[6,68] The US National Institutes of Health (NIH) requires a scientific or ethical justification for age-related exclusions in supported human research, offering a design principle for consideration in Qatar.[69] In a US healthcare algorithm, using spending as a proxy for need underestimated illness among Black patients.[70] Qatar's research commissioning process should examine whether age, language, disability or differences in prior access distort predictions, and provide accessible alternatives and human interaction.[68,71]

Disability inclusion and participation

Disability-inclusive care should reflect individual support needs and goals. For people with lifelong physical, sensory, intellectual or psychosocial disabilities, transition to adult services may require co-ordinated rehabilitation, communication support and treatment alongside education or employment. Adults with acquired functional limitations may require accessible housing, assistive equipment and

support with daily activities. WHO reports on disability and assistive technology support co-ordination across these services.[9,72] Evaluation should include autonomy, symptoms and participation alongside clinical measures of function.



For people with lifelong physical, sensory, intellectual or psychosocial disabilities, transition to adult services may require co-ordinated rehabilitation, communication support and treatment alongside education or employment.

Disability can also include the problems with normal daily activities that come with aging. Environmental support can also improve function. The US Community Aging in Place – Advancing Better Living for Elders (CAPABLE) trial randomized 300 low-income, cognitively intact adults aged at least 65 years who reported having difficulty with occupational therapy, nursing and home modifications or an attention control – measured as an activities of daily living (ADL) disability score. At five months, the intervention group had a 30 percent lower ADL disability score (adjusted ratio 0.70; 95 percent confidence interval 0.54–0.93), whereas the instrumental ADL result was not statistically significant (0.83; 0.65–1.06), and between-group differences were not significant at 12 months.[73] This is evidence of short-term improvement in an ADL disability score in a selected population, with durability requiring further attention.

In Qatar, PHCC and HMC could connect individual care and rehabilitation plans with the Ministry of Social Development and Family (MSDF) and community organizations. The proposed pathway should identify a responsible team and confirm that referrals are completed.[9,72] Service users and caregivers should help define goals and review delivery. Commissioners should fund the support needed to participate and report uptake, completed transitions, unmet need and outcomes valued by participants by disability and functional status, with consent and privacy safeguards.

SECTION 3. COMBINING ESTABLISHED CARE WITH EMERGING SCIENCE

This section focuses on the second principle in the proposed policy framework – implementation and expansion of established support. It examines how existing general healthcare programs for separate health issues – from blood pressure and blood sugar monitoring to bone health and cancer screenings – could combine with emerging geroscience to improve clinical outcomes across a healthy longevity life course. It looks at established prevention programs, and clinical trials of established clinical treatments that have the potential to apply to broader healthy longevity applications, and how these could be implemented with the right evidence pathways and regulation.

3.1 THE CONTRIBUTION OF GEROSCIENCE

Geroscience involves investigating whether sharing health interventions that target biological processes across diseases can improve clinical outcomes beyond those achieved with existing care.[5,27] Precision geromedicine seeks to translate such knowledge into individual assessment and intervention. Each proposed application requires evidence for the population, outcome and duration of use, including effects on a person's function, participation, harms and cost.[5,6] The Appendix details gerodiagnostic approaches, including biomarkers of aging, and gerointerventions that are intended to improve health and function.



This report's proposed clinical pathway comprises assessment of the health interventions, an agreed patient care plan and reassessment at follow-up stages.

This report's proposed clinical pathway comprises assessment of the health interventions, an agreed patient care plan and reassessment at follow-up stages. Established clinical measures identify risks, disease and support needs. Tests of those clinical measures should only be adopted when they demonstrably improve clinical decision-making and follow-up is necessary to evaluate benefit, harm, adherence and changing circumstances.[6,23,24] This can strengthen existing primary and specialist care while providing a controlled setting to evaluate emerging geroscience applications.

The biology of aging

The biology of aging provides a rationale for investigating health processes that are shared across chronic conditions. The 2023 *Hallmarks of aging: An expanding universe* framework describes 12 interacting mechanisms, including genomic and epigenetic change, altered nutrient sensing, mitochondrial dysfunction, senescence and chronic inflammation.[74] A study of lifespan extension in mice using gerotherapeutics such as rapamycin[75] and senolytic treatment[76] supports translation into human research. However, before treatments are given widespread human application, their benefits and safety must be evaluated.[5]

3.2 HEALTH ASSESSMENTS LINKED TO CLINICAL DECISIONS

Current health checks should be assessed to see whether they can be linked to emerging geromedicine. This should lead to an evidence-based action, appropriate support or a clear research question. Table 1 provides a general overview of current health assessment options, and the population, measurement, supporting source and limitation for each assessment. For example, Qatar's breast,[79] bowel[80] and cervical[81] screening pathways and local fracture-risk guidance[82] inform the corresponding clinical decisions. Primary Health Care Corporation (PHCC) Annual Health Checks provide another established entry route for eligible residents.[83] Functional assessment complements disease-risk assessment. Molecular and digital assessments need validation for their intended use and evidence of added decision value.[6,84]

Table 1. Current health assessment choices, supporting evidence and limits

Current health assessment and population	What to measure	Evidence and certainty for the stated purpose	Decision and limits
Blood pressure: Adults without known hypertension or with suspected hypertension	Standardized office readings, ambulatory or home confirmation where appropriate.[85]	High, source-rated: screening and diagnostic confirmation have substantial net benefit (USPSTF grade A).[86] WHO and ACC/AHA provide treatment guidance.[85,87]	Implement. Use validated equipment, standard technique and out-of-office confirmation where appropriate.[86] Apply the locally adopted diagnostic and treatment pathway.
Lipids and cardiovascular risk: Adults considered for primary or secondary prevention	Lipid profile, smoking, blood pressure, diabetes and clinical history; appropriate cardiovascular risk estimation.[88]	High for cardiovascular event reduction with indicated lipid-lowering treatment. NICE guidance links assessment to treatment.[88] STAREE supplies direct older-adult trial evidence.[89]	Implement indication-based assessment. Qatar's 2024–2030 cardiometabolic action plan provides policy context.[52] Specify the risk model and locally adopted thresholds.
Glycemia: Adults meeting age- or risk-based screening criteria	HbA1c, fasting plasma glucose or oral glucose tolerance testing as appropriate.[90]	Guideline-supported diagnostic criteria, certainty is recommendation-specific in ADA 2026.[90] Diabetes prevention benefits in high-risk adults are supported by a large randomized trial.[91]	Implement within clinical eligibility. Confirm abnormal results unless hyperglycemia is unequivocal.[90]
Kidney health: Adults at risk of chronic kidney disease (CKD)	Estimated glomerular filtration rate and urine albumin-to-creatinine ratio. (See *Kidney Disease: Improving Global Outcomes*, Practice Point 1.1.1.1)[92]	KDIGO ungraded practice points support combined filtration and albuminuria assessment.[92] High-certainty treatment evidence in eligible CKD populations is a separate basis for acting on results.[93]	Implement risk-based assessment. Repeat incidental abnormalities and establish chronicity before diagnosing CKD.[92] Do not treat a single low filtration estimate as a biological age measure.

Current health assessment and population	What to measure	Evidence and certainty for the stated purpose	Decision and limits
Fracture risk and bone health: Postmenopausal women, and men aged over 50 years in Qatar	Clinical fracture risk factors, Qatar FRAX, selective DXA according to risk. (See the fracture risk assessment in *Guidelines for fracture risk assessment and management of osteoporosis in postmenopausal women and men above the age of 50 in Qatar*.)[82]	Local consensus guideline, ungraded as a whole, uses Qatar FRAX and local epidemiology.[82] High for fracture reduction with zoledronate in the specific trial population.[94]	Implement the Qatar risk-based pathway. Apply its assessment and intervention thresholds. Routine DXA without relevant risk factors is discouraged.[82] Evidence for fracture prevention does not validate general biological age testing.
Breast cancer screening: Asymptomatic women aged 45–69 years in the PHCC program	Mammography every three years under the published PHCC program. (See Breast Cancer Screening. Scope of Service, Target Group and Other information.)[79]	Moderate, source-rated, for net benefit of biennial mammography at 40–74 years in US guidance (grade B).[95] PHCC specifies a different local age range and three-year interval.[79]	Implement the published Qatar program.[79] The external evidence grade does not validate Qatar's exact interval nor estimate local mortality reduction. Abnormal screens need assessment and symptoms need a diagnostic pathway.
Bowel cancer screening: Asymptomatic PHCC-registered people aged 50–74 years	Fecal immunochemical testing every two years. (See Bowel Cancer Screening. Scope of Service, Target Group and Other information.)[80]	High, source-rated, for net benefit of colorectal screening at age 50–75 years (USPSTF grade A).[96] PHCC specifies fecal immunochemical testing every two years.[80]	Implement the published Qatar pathway and follow-up of positive results.[80] External evidence supports screening.

Current health assessment and population	What to measure	Evidence and certainty for the stated purpose	Decision and limits
Cervical cancer screening: Eligible asymptomatic women aged 21–69 years in the PHCC program	PHCC describes cervical cytology with HPV testing according to smear results: every three years at 21–49 years and every five years at 50–69 years.[81]	High, source-rated, for specified screening strategies at 21–65 years in US guidance (grade A).[97] PHCC separately defines local ages, cytology and reflex HPV testing.[81]	Implement Qatar eligibility and referral arrangements, considering prior screening, cervical surgery and individual risk.[81] The international grade does not endorse every local age/interval combination.
Muscle strength and physical performance: People with suspected sarcopenia, principally older adults	Grip strength or chair stands, muscle quantity/quality to confirm sarcopenia, gait speed or Short Physical Performance Battery to assess severity.[98]	Ungraded consensus informed by validation studies: low strength indicates probable sarcopenia; low muscle quantity or quality confirms it.[98] This classification is not evidence that universal screening improves outcomes.	Implement clinically indicated assessment. Use standard protocols and applicable reference values. Investigate causes and connect findings to exercise, nutrition or rehabilitation.[98,99] European cut-offs require appraisal before population-wide use in Qatar.
Intrinsic capacity and unmet needs: Adults in primary care	Locomotion, cognition, vitality, psychological and sensory capacities, with social support and care needs.[24]	WHO ICOPE practice guidance, ungraded as a complete pathway. A positive initial screen leads to detailed assessment and an individual care plan.[24] Qatar has an established ICOPE service.[100]	Implement within the older-person pathway and evaluate outcomes. Universal cognitive screening in asymptomatic adults aged 65 years or over has insufficient evidence of net benefit (USPSTF I statement).[101] Symptoms or concerns warrant clinical assessment.
Aerobic fitness: People whose management can be informed by the result	Clinically appropriate exercise testing or validated estimates of fitness.[102]	Moderate for prognostic association, based mainly on observational cohorts summarized in the AHA statement.[102] No direct evidence that universal cardiopulmonary exercise testing improves outcomes.	Use selectively for a defined clinical or exercise-prescription purpose. Estimated fitness and directly measured oxygen consumption are not interchangeable. Report method, units, reference population and safety assessment.[102]

Current health assessment and population	What to measure	Evidence and certainty for the stated purpose	Decision and limits
Digital measurements: Specified device, software, population and purpose	Physical activity, gait, sleep or other physiological signals from a specified device and software version.[84,103]	Ungraded validation framework and review: verification, analytical validation and clinical validation are distinct.[84,103] Certainty depends on the individual device and clinical application.	Implement only a validated, actionable use and evaluate additional clinical claims. Assess missing data, accessibility, privacy and the capacity to review results. Validation of step counts does not establish diagnostic or treatment selection validity.
Molecular and composite aging measures: Research populations appropriate to the model	DNA methylation, proteomic and composite physiological aging models.[104–107]	Observational development and validation support specified associations or predictions.[104,105] No direct evidence from these sources that personalized, clock-guided treatment improves patient outcomes.[6]	Evaluate in research. Establish reproducibility, external validation, incremental value and a prespecified clinical decision. A lower biological age score is not a validated substitute for improved function, fewer disease events or longer survival.[6]

Evidence key: Certainty applies to the stated outcome and population, not to an entire test or product. High, moderate, low and very low indicate decreasing confidence in the result. Published ratings are marked 'source-rated'; other ratings are provisional appraisals for this narrative report, with reasons stated, not a formal Grading of Recommendations Assessment, Development and Evaluation (GRADE) assessment.[17] 'Ungraded' denotes guidance or validation evidence without an applicable certainty rating; 'no direct evidence' denotes an untested clinical-use claim. Test accuracy and prognostic association are separate from benefit from test-guided care.[18] An implementation decision also considers harms, access, resources and local authorization.

Abbreviations: ACC: American College of Cardiology; ADA: American Diabetes Association; AHA: American Heart Association; CKD: chronic kidney disease; DXA: dual-energy X-ray absorptiometry; ECG: electrocardiogram; FRAX: fracture risk assessment tool; HbA1c: glycated hemoglobin; HPV: human papillomavirus; ICOPE: Integrated Care for Older People; KDIGO: Kidney Disease: Improving Global Outcomes; NICE: National Institute for Health and Care Excellence; PHCC: Primary Health Care Corporation; STAREE: Statin Therapy for Reducing Events in the Elderly; USPSTF: US Preventive Services Task Force; WHO: World Health Organization.

3.3 HEALTHY LONGEVITY INTERVENTIONS SELECTED BY EVIDENCE AND NEED

Gerointerventions are health approaches that aim to influence aging trajectories; gerotherapeutics include medical and non-medical approaches under the geromedicine definition.[29]

Established prevention and disease treatments should retain their demonstrated purposes. Any proposed additional gerotherapeutic use will require evidence in a particular population and for a specific outcome.[5]

Table 2 presents examples of interventions designed to encourage healthy longevity. The table highlights the studied result, with the certainty and implementation decision separately, including negative findings that warrant caution.

Emerging combinations of existing treatments and new geromedicine need to be evaluated for benefit, harm, adherence and interactions.[5]

Table 2. Examples of interventions for healthy longevity: evidence and recommendations

Intervention and implementation decision	Best evidence and observed result	Certainty and limits for the stated use
Tobacco control and cessation: Implement	WHO recommends population tobacco-control measures.[4] Its 2024 clinical guideline supports behavioral assistance and effective cessation medicines for adults who want to quit.[108]	High for cessation benefit from established medicines and behavioral support; certainty varies by component.[108] Select treatment for eligibility, contraindications and local availability. A combined local program still requires delivery and equity evaluation.
Physical activity, strength and balance: Implement	WHO guidance covers age- and ability-specific activity.[44] A Cochrane review included 108 trials and 23,407 participants; exercise reduced fall rate by 23% (rate ratio 0.77; 95% CI 0.71–0.83).[109] LIFE randomized 1,635 older adults and reduced major mobility disability.[110]	High, source-rated, for fall reduction in community-dwelling older adults; lower certainty for fractures and hospitalization.[109] Moderate for mobility-disability benefit in LIFE's selected population.[110] Qatar's activity guideline supports local adaptation.[48]
Dietary pattern and food environment: Implement	WHO recommends population dietary measures.[4] The corrected PREDIMED analysis (7,447 adults at high cardiovascular risk) found fewer major cardiovascular events with Mediterranean diets supplemented by olive oil or nuts.[54]	Moderate for cardiovascular benefit in the PREDIMED population, considering allocation departures and applicability.[54] Evidence for each food-policy measure should be appraised separately. Individual treatment of malnutrition follows nutritional assessment.[99]
Lowering blood-pressure: Implement for a clinical indication	An individual-participant meta-analysis of 48 trials found about 10% fewer major cardiovascular events per 5 mmHg systolic reduction.[49] WHO provides treatment guidance.[87] SPRINT informs intensive treatment in selected high-risk adults without diabetes.[111]	High for cardiovascular-event reduction with indicated treatment.[49] Intensive targets require individual assessment and monitoring for hypotension, electrolyte disturbance and acute kidney injury.[111] Use the locally adopted pathway.

Intervention and implementation decision	Best evidence and observed result	Certainty and limits for the stated use
Statins: Implement for supported prevention indications	STAREE (9,971 adults aged at least 70 years without cardiovascular disease, diabetes or dementia) found fewer major cardiovascular events with atorvastatin (HR 0.70; 95% CI 0.61–0.82), without significant improvement in disability-free survival (HR 0.94; 0.84–1.05).[89]	High for cardiovascular-event reduction in the studied population; no demonstrated disability-free-survival benefit over median 5.9 years.[89] Apply risk-based prescribing, preferences, harms and local guidance.[88]
GLP-1 receptor agonists: Implement for supported clinical indications	SELECT (17,604 participants with overweight/obesity and established cardiovascular disease, without diabetes): major cardiovascular events 6.5% versus 8.0% with semaglutide versus placebo.[112] FLOW supports kidney benefit in type 2 diabetes with CKD.[113]	High for the agent-, population- and outcome-specific trial benefits.[112,113] No established longevity indication in healthy, normal-weight adults. Monitor tolerability, nutrition and muscle function during weight loss. The joint nutrition advisory is practice guidance.[114]
SGLT2 inhibitors: Implement for supported kidney or heart-failure indications	EMPA-KIDNEY supports empagliflozin in eligible CKD populations.[93] DELIVER supports dapagliflozin in heart failure with mildly reduced or preserved ejection fraction.[115] These include specified groups without diabetes.	High for trial-defined kidney and heart-failure outcomes.[93,115] Broader aging claims remain unproven. Apply kidney-function criteria and counselling on volume depletion, genital infection and ketoacidosis, including perioperative interruption where indicated.[92]
Fracture prevention: Implement for elevated fracture risk	Qatar's 2024 consensus guideline recommends risk-stratified treatment.[82] Zoledronate reduced fragility fractures in 2,000 women aged at least 65 years with osteopenia (HR 0.63; 95% CI 0.50–0.79).[94]	High for fracture reduction in the trial population. The local screening algorithm is consensus-based.[82,94] Select treatment by fracture risk, contraindications and patient preference. Do not extrapolate to universal longevity treatment.
Multidomain support for cognition: Implement supported components and evaluate delivery	FINGER (1,260 participants) evaluated diet, exercise, cognitive training and vascular-risk monitoring.[116] US POINTER (2,111 participants) found a greater two-year improvement in global cognition with structured than self-guided intervention.[117]	Moderate for small cognitive-test benefits in the studied at-risk populations, with uncertain long-term functional relevance.[116,117] Dementia prevention and the independent contribution of each component are not established by these package trials.

Intervention and implementation decision	Best evidence and observed result	Certainty and limits for the stated use
Rehabilitation and home adaptation: Implement indicated support and evaluate local models	CAPABLE randomized 300 low-income older adults with disability to a person-and-home intervention or attention control. Activities-of-daily-living disability improved at five months; instrumental-activity and 12-month differences were not significant.[73]	Moderate for short-term disability score improvement, limited durability and generalizability.[73] WHO supports assistive-technology access, but this policy guidance is not an efficacy trial.[72] Define Qatar eligibility, workforce and follow-up.
Metformin for physical frailty without a diabetes indication: Do not offer routinely for this purpose	MET-PREVENT (72 older adults with probable sarcopenia and prefrailty/frailty) found no improvement in gait speed over four months (difference 0.001 m/s; 95% CI −0.06 to 0.06), with poor tolerability and more hospital admissions.[118]	Low certainty about the size of any physical-function effect because the trial was small and short; benefit was not demonstrated in this population.[118] Established diabetes treatment and prevention in selected high-risk people are separate uses.[91] Broader longevity use remains investigational.
Rapamycin or rapalogs for healthy longevity: Evaluate in research	A human systematic review identified limited physiological signals and substantial gaps.[119] RAPA-EX-01 (40 adults, 13 weeks) found no significant improvement in its primary chair-stand test outcome and a higher adverse-event burden with weekly sirolimus plus exercise.[120]	Low for sustained clinical benefit: small heterogeneous studies, short follow-up and mixed or negative functional results.[119,120] No demonstrated human lifespan extension. Evaluate dose, infection risk, metabolic effects and exercise interactions.
Senolytics: Evaluate in research	The combination of dasatinib and quercetin was studied in an uncontrolled diabetic-kidney-disease pilot: 11 participants enrolled and nine with evaluable adipose tissue. Selected senescence measures changed; the corrigendum revised several findings.[121]	Very low for clinical benefit: no control group, small sample and biomarker outcomes.[121] Animal efficacy[76] does not establish human benefit, optimal dosing or long-term safety. Research requires defined outcomes and independent safety oversight.

Intervention and implementation decision	Best evidence and observed result	Certainty and limits for the stated use
NAD precursors: Evaluate defined oral uses in research	The systematic review describes heterogeneous human and preclinical studies: increases in NAD-related metabolites do not establish improved healthspan.[122] Oral NMN product testing identified variability in labeled content.[123]	Low for sustained patient-relevant benefit; no established lifespan benefit.[122] Evidence is compound-, dose- and route-specific. Intravenous NAD is not supported by oral-precursor studies and sterile-compounding concerns are a separate safety issue.[124]
Supplements: Treat established deficiencies; no general longevity recommendation	VITAL did not significantly reduce primary cancer or major cardiovascular outcomes with vitamin D[125] or marine omega-3.[126] COSMOS-Web found a modest memory benefit.[127] Urolithin A did not improve its primary walk-distance or ATP-production outcomes.[128]	High for the VITAL primary-outcome estimates, which showed no statistically significant benefit; moderate for the narrow COSMOS memory outcome; low for broader urolithin A clinical benefit because primary outcomes were negative and positive findings were secondary.[125–128] Assess each supplement separately; correction of deficiency remains a distinct indication.[99]
Partial cellular reprogramming: Early human ocular research and systemic uses preclinical	ER-100 is a registered phase 1 ocular safety study in optic neuropathies.[129] Studies with mice support mechanistic investigation of reprogramming and visual recovery.[130,131] Registration and first dosing are not efficacy results.	No direct clinical efficacy evidence in the cited registry; preclinical evidence for broader systemic claims.[129–131] Keep local ocular development distinct from systemic use and require long-term assessment of abnormal growth and other delayed harms.
Unsubstantiated marketed rejuvenation interventions: Do not offer routinely	FDA warns that young-donor plasma has no proven benefit for aging-related uses and carries transfusion risks.[132] Peptide claims require product- and indication-specific evidence; advisory-committee discussion is not proof of efficacy or authorization.[133]	No direct clinical outcome evidence for the specified unsupported rejuvenation claim or an untested marketed combination. Safety concerns cannot be offset by mechanistic plausibility. Require substantiated claims and applicable regulatory compliance.[132,133]

Intervention and implementation decision	Best evidence and observed result	Certainty and limits for the stated use
Aspirin for primary prevention in healthy older adults: Do not offer routinely	The ASPREE program (19,114 participants) did not improve disability-free survival[134] and increased major bleeding.[135] USPSTF recommends against starting aspirin for primary cardiovascular prevention at age 60 years or over.[136]	High for increased major bleeding and no demonstrated disability-free-survival benefit in the studied population.[134,135] This decision does not remove separate secondary-prevention indications.

Evidence key: Certainty applies to the stated outcome and population, not to an entire test or product. High, moderate, low and very low indicate decreasing confidence in the result. Published ratings are marked 'source-rated'; other ratings are provisional appraisals for this narrative report, with reasons stated, not a formal GRADE assessment.[17] 'Ungraded' denotes guidance or validation evidence without an applicable certainty rating; 'no direct evidence' denotes an untested clinical-use claim. Test accuracy and prognostic association are separate from benefit from test-guided care.[18] An implementation decision also considers harms, access, resources and local authorization.

Implementation decisions are use-specific: Implement established evidence-based care, evaluate investigational human applications, continue preclinical research, or do not offer routinely when benefit is unsubstantiated or harms outweigh expected benefit. A null trial is reported as no demonstrated benefit, not proof that every possible effect is absent.

Abbreviations: ASPREE: Aspirin in Reducing Events in the Elderly; ATP: adenosine triphosphate; CAPABLE: Community Aging in Place – Advancing Better Living for Elders; CI: confidence interval; CKD: chronic kidney disease; COSMOS-Web: The Cocoa Supplement and Multivitamin Outcomes Study Web (COSMOS-Web) ancillary study; DELIVER: Dapagliflozin Evaluation to Improve the Lives of Patients with Preserved Ejection Fraction Heart Failure; EMPA-KIDNEY: Study of Heart and Kidney Protection with Empagliflozin; ER-100: investigational AAV-based gene therapy; FDA: US Food and Drug Administration; FINGER: Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability; FLOW: Evaluate Renal Function with Semaglutide Once Weekly; GLP-1: glucagon-like peptide-1; HR: hazard ratio; LIFE: Lifestyle Interventions and Independence for Elders; MET-PREVENT: trial of metformin diabetes medication in improving physical performance in older people with sarcopenia; NAD: nicotinamide adenine dinucleotide; NMN: nicotinamide mononucleotide; PREDIMED: PREvenciOn con DIeta MEDiterranea; RAPA-EX-01: trial of rapamycin; SELECT: Semaglutide Effects on Cardiovascular Outcomes in People with Overweight or Obesity; SGLT2, sodium–glucose cotransporter 2; SPRINT: Systolic Blood Pressure Intervention Trial; STAREE: Statin Therapy for Reducing Events in the Elderly; US POINTER: U.S. Study to Protect Brain Health through Lifestyle Intervention to Reduce Risk; VITAL: Vitamin D and Omega-3 trial; WHO: World Health Organization.

Established prevention and support for function

Selection of prevention and support programs should extend beyond activity and nutrition to indicated vaccination and screening, cardiovascular and metabolic risk management, mental and sensory health, falls and fracture prevention, oral health and rehabilitation. Treatment prioritization should follow population burden, evidence, eligibility and service capacity.[4,24,30,94] Assessment of a person's health should integrate nutrition, sleep, physical activity, oral health, psychological wellbeing, medication use and social circumstances in one care plan. Testing and supplementation should follow clinical need and evidence, with measurable goals and a review date. Practical access, affordability and support for patients to help them adhere to treatment should be part of delivery.

Clinical benefits and investigational applications

Trials of glucagon-like peptide-1 (GLP-1) receptor agonists and sodium–glucose cotransporter 2 (SGLT2) inhibitors demonstrate clinical benefits in defined clinical populations.[93,112] Those uses support established clinical care, but broader uses for healthy longevity require separate evaluation. The Australian Aspirin in Reducing Events in the Elderly (ASPREE) and Statin Therapy for Reducing Events in the Elderly (STAREE) trials illustrate the distinction between clinical endpoints: aspirin did not improve disability-free survival (the time a person lives without mental or physical impairment caused by aging) in healthy older adults,[134] while atorvastatin reduced cardiovascular events in STAREE without a significant improvement in disability-free survival over the observed period.[89]

Repurposed medicines have known pharmacology (their effect on the biological system), but new preventive uses still require direct benefit–harm evidence.[137] Rapamycin has evidence from trials with mice,[75] while the human systematic review and exercise trial show limited, heterogeneous or negative clinical signals.[119,120] Metformin did not improve gait speed in the MET-PREVENT trial, and was poorly tolerated in a frail older population.[118] Senolytic evidence remains exploratory, including small uncontrolled studies.[121] For supplements, the Vitamin D and Omega-3 trial (VITAL) did not demonstrate its primary cancer or cardiovascular benefits with vitamin D or marine omega-3;[125,126] the Cocoa Supplement and Multivitamin Outcomes Study Web (COSMOS-Web) reported a narrower memory benefit,[127] and urolithin A had negative primary functional and mitochondrial outcomes despite positive secondary findings.[128] These results do not support a reliable numerical estimate of the probability that a candidate will extend human healthspan. Research prioritization should consider mechanism, reproducible human signals, clinically meaningful outcomes, and the feasibility of long-term safety assessment.

Biomarkers of aging can characterize biological processes and measure treatment response, but the engagement of a target demographic group does not itself establish clinical benefit or validate a surrogate endpoint.[6] Large research initiatives can support standardization of assessment and clinical evaluation. The XPRIZE Healthspan global competition to incentivize therapeutics for healthy longevity is focused on functional assessment,[57] while the Advanced Research Projects Agency for Health (ARPA-H) Proactive Solutions for Prolonging Resilience (PROSPR) program supports new measurements and clinical testing.[60] These programs'

endpoints, protocols and results can inform wider research, provided that the distinction between program targets, emerging evidence and validated clinical benefit remains clear.[6,57,60]

3.4 EVIDENCE PATHWAYS AND RESPONSIBLE IMPLEMENTATION

Development programs should specify the biological or clinical question and the patient-relevant outcomes to be evaluated. There needs to be early agreement from regulators, patients, clinicians, funders, payers or commissioners, and health-technology assessment bodies on the intended use, acceptable endpoints, safety requirements and feasible delivery model.[6,77,78]

Evidence requirements should be proportionate to the proposed clinical or commissioning decision.

Early studies assess mechanism, dose and safety, whereas comparative trials assess clinical benefit, and implementation studies assess whether benefit is retained in routine delivery.[5,6] A national review group could define the criteria for progression or stopping the treatment. They should publish the reasons for adoption or non-adoption, and review emerging evidence at least annually. A registry would support surveillance and evaluation. Shared trial infrastructure, cohorts and biobanks could strengthen recruitment, independent biomarker validation and longer-term safety follow-up. Protocols and negative findings should be reported openly, with appropriate requirements for good clinical practice.[138]

SECTION 4. LESSONS FROM INTERNATIONAL PROGRAMS

This section focuses on the third principle in the proposed policy framework: co-ordination across health, education, employment, finance, social protection and the built environment. To examine how this co-ordination could work in practice, this section looks at international programs – from Singapore, Japan, the UK, Ethiopia, Rwanda, and the so-called 'Blue Zone' populations that experience healthy longevity – with potential lessons for Qatar. These international examples are highlighted to show how a coherent global strategy could work, but also how Qatar could focus national healthy longevity policy. The section recommends education and specialist training for health and geroscience practitioners to ensure the competencies needed to promote and apply healthy longevity in practice, including a competency framework for health professionals. It also looks at future research and how it should support the national priorities for Qatar.

4.1 NATIONAL HEALTHY LONGEVITY PROGRAMS

The examples in this section compare prevention and delivery, available outcome evidence, and implications for Qatar. (Measures and evaluation designs differ, so the figures should not be interpreted as a ranking of national performance.)

Singapore: Co-ordinated investment

Singapore combines primary healthcare reform with sustained investment in healthy longevity research.[59,139] Launched in July 2023, Healthier SG connects residents with a family doctor to develop personalized health plans involving regular consultations and progress review.[139,140] Primary prevention care includes support for healthier lifestyles, adult vaccination and links to community activities, alongside eligible screening and chronic-disease care.[139]

Singapore's National Steps Challenge complements primary care by encouraging everyday physical activity. Among those due for an annual health plan review in 2025, 66 percent completed it that year.[140] By May 2026, more than 1.4 million residents had enrolled, representing 59 percent of the eligible population.[140] Program coverage is measured by enrolment numbers, with completed review measures showing the continuity of follow-up.[140] The population-wide evaluation reports participation and activity outcomes rather than proven gains in healthspan.[45,47]

Singapore's PRECISE-SG100K data resource combines about 100,000 residents' genomic and cohort data with electronic health records under controlled access. Recruitment reached 100,000 in April 2025 and whole-genome sequencing was completed in June 2025.[141] Like UK Biobank (see below), the data set supports longitudinal population research, (although the populations and study designs differ).[141,142]

Alexandra Hospital's pilot Healthy Longevity Clinic, launched in August 2023, provides a clinical testbed: the observational Health Enhancing Active Living (HEAL) study evaluates clinical outcomes, service use, patient experience and costs. However, these are evaluation objectives, not established evidence of effectiveness.[143]

The National University of Singapore's Academy for Healthy Longevity complements this work through professional education.[25] And, in 2026, the Singapore Government committed S$350 million to the Grand Challenge on Maximising Healthy and Successful Longevity under its Research, Innovation and Enterprise 2030 plan.[59]

Lessons for Qatar: The policy lesson for Qatar is to connect prevention, longitudinal data, and evaluated clinical services under evaluation and professional education. PHCC Annual Health Checks provide an existing service foundation for the proposed national framework.[16,83]

Japan: Health in an aging society

Japan combines population-wide prevention care with universal health insurance and community services. Public health measures, blood-pressure control and access to treatment led to reductions in infectious-disease and stroke mortality, and historical gains in survival.[144]

In 2022, life expectancy was 81.05 years for males and 87.09 years for females, while 'healthy life expectancy' – years without health-related limitations in daily activities – was 72.57 and 75.45 years, respectively.[146] The resulting gaps were about 8.5 and 11.6 years – expected time with activity limitations across life, rather than years toward the end of life. Healthy life expectancy was broadly unchanged between 2019 and 2022.[146] And between 2014 and 2024, the employment rate among people aged 65–69 years rose by 13.5 percentage points.[146]

Long survival therefore coexists with substantial care needs. In Japan's 2022 household survey, the leading reported causes of needing long-term care or support were dementia (16.6 percent), stroke (16.1 percent) and fractures or falls (13.9 percent) among people certified as needing care or support and living at home.[147] Okinawa's historical Blue Zone status (the island reportedly has a large population of healthy centenarians) concerns validated older birth cohorts; the recent review reports that it no longer meets the same exceptional-longevity criteria. It should not be used to characterize current health across Japan.[148]

Health Japan 21 (third term, 2024–2035) sets goals for healthier behaviors and environments, longer healthy life expectancy and reduced health disparities.[145] Japan's 2025 *Annual Report on the Ageing Society* records that 29.3 percent of the population was aged 65 years or over in October 2024.

Lessons for Qatar: While recognizing Japan's different demographic structure, the policy lesson for Qatar is to pair prevention with rehabilitation, accessible environments and support for participation.

The UK: Translating research into better health

The UK combines extensive research infrastructure with a pressing need to improve population health.[142,149] UK Biobank follows about 500,000 participants, linking biological, clinical and lifestyle information with health outcomes.[142] Official estimates for 2022–2024 put healthy life expectancy at birth at 60.7 years for males and 60.9 years for females, reductions of 1.8 and 2.5 years, respectively, compared with 2019–2021.[149] These estimates measure expected years in self-reported good general health and are designated official statistics in development because of declining survey sample sizes.[149] The 2025 *Fit for the Future: 10 Year Health Plan for England* prioritizes community care, digital services and prevention.[150] For a healthy longevity strategy, a relevant objective is to integrate research with funded services that promote health and preserve function.[3,150]

Lessons for Qatar: Qatar could build this connection into program design through defined clinical pathways, support for continuing care, and routine reporting of outcomes and inequalities.[3,142,150]

Ethiopia and Rwanda: Providing the foundations of accessible care

Ethiopia's Health Extension Program is an example of sustained investment in a community health workforce.[64,151] Launched in 2003, the program brings primary care into communities through health extension workers and local health posts.[64] A 2023 evaluation reported that more than 42,000 workers had been trained and deployed. Across four studied regions, modeling estimated that changes in service coverage attributable to the program yielded about 50,700 net maternal and child lives saved between 2008 and 2017.[151] The program's relevance to healthy longevity lies in the delivery infrastructure: trained staff, proximity to households and continuity between community services and primary care.[64] Applying these principles across adulthood would require workforce competencies and referral arrangements suited to health promotion and the changing burden of chronic disease.[3,64]

Rwanda illustrates the complementary role of financial protection. The 2023–2024 Integrated Household Living Conditions Survey found that 85.3 percent of the population had health insurance, around 11 percentage points more than in 2016–2017. Community-based schemes covered 93 percent of insured people.[152]

An earlier International Monetary Fund (IMF) Working Paper econometric analysis reported lower out-of-pocket expenditure and catastrophic spending with community-based insurance, with effects varying by income group.[65] Taken together, the Ethiopian and Rwandan examples complement the prevention and research models by showing how community delivery and financial protection can support access. However, their service coverage and modeling results do not establish a causal effect on healthy life expectancy.

Lessons for Qatar: For Qatar, proposed programs should identify practical and financial barriers among citizens and resource support within national eligibility arrangements.

4.2 QATAR AND AN INTEGRATED NATIONAL FRAMEWORK

Qatar's population is predominantly of working age. This supports the prioritization of prevention and preservation of health during adulthood.

Existing evidence and initiatives

The MoPH *Qatar Health Brief Report 2024* records that 73.2 percent of the population was aged 25–64 years and 1.5 percent was aged 65 years or over in August 2024.[51] In its Health Risk Prevalence Data (STEPwise Survey 2023) results, collected from May 2023 to January 2024 among adults aged 18–69 years, obesity (body mass index ≥30 kg/m²) was 33.4 percent and insufficient physical activity was 37.5 percent.[51] These figures support early action on cardiometabolic health and function. The Global Burden of Disease Study 2023 also identified road traffic injuries as a cause of premature mortality among young men.[153] The STEPwise estimates provide a starting point for prevention planning; and MoPH should document the survey population, weighting and indicator definitions before adopting national targets.[51]

The National Health Strategy 2024–2030 and HMC Healthcare Strategy 2024–2030 already provide strong policy foundations.[16,38] Qatar also has PHCC preventive and wellness services,[83] Integrated Care for Older People (ICOPE) and older-person care,[100] a WHO-recognized Healthy Cities network,[154] social protection services,[155] and research and precision-health resources.[156] Qatar's 79th World Health Assembly (WHA79) healthy-longevity side event in May 2026 added an international convening platform.[157] The proposed national framework would co-ordinate these services, institutions and research programs with existing MoPH and World Innovation Summit for Health (WISH) initiatives. Cardiometabolic prevention, early detection and appropriate management are proposed priorities for appraisal, selected alongside early development, mental health, injury prevention, disability inclusion and other national needs.

Investing in established prevention in Qatar

Economic modeling allows us to assess investment in established prevention in Qatar. The Qatar component of a 2022 economic evaluation covering six Gulf Cooperation Council (GCC) countries estimated that scaling up tobacco control, salt reduction, physical activity awareness and primary-care interventions for cardiovascular disease and diabetes could generate about 134,000 healthy life-years and avert about 22,900 premature deaths over 15 years, while restoring about $7.5 billion in productivity.[158] The model used 2019 economic inputs, assumed rapid scale-up of policy interventions within two years, and increased effective coverage of clinical interventions from an assumed 5 percent to 80 percent over 15 years.[158] These are scenario estimates, not observed gains or a 2026 budget forecast. Before using them for financing decisions, MoPH should update baseline risks, population composition, current service coverage, delivery costs and feasible take-up, and test alternative coverage assumptions.

Qatar Precision Health Institute (QPHI) brings together the Qatar Biobank and the Qatar Genome Program, providing a foundation for longitudinal and translational research.[156] Proposed linkage with clinical records, repeated functional assessment and population-health studies should use appropriate consent, privacy safeguards and representative sampling. Established preventive services,

implementation science and evaluation of access could be included in the research portfolio alongside geroscience programs and research into gerodiagnostics and gerointerventions. Precision geromedicine studies should test whether information from gerodiagnostics, such as biomarkers of aging or genomic data, adds to established clinical assessment, changes care and improves outcomes.

Table 3 shows some of the existing health programs in Qatar that could become foundations for proposed deliverables in longevity health.

Table 3. Qatar's foundation programs and evidence for proposed deliverables

Verified Qatar foundation and source status	Evidence for proposed deliverables
MoPH National Health Strategy 2024–2030. Official national policy with strategic directions.[16]	Map the healthy longevity roadmap to existing commitments, identify gaps and cost delivery. Policy alignment is supported by the National Health Strategy 2024–2030.[16]
Primary Health Care Corporation (PHCC) Annual Health Checks. Official service specification: eligibility and nurse/physician assessment pathway. This is not a comprehensive gerodiagnostic panel.[83]	Use eligible health checks for risk assessment and supported referral, separately plan access for currently ineligible residents. Audit completed care. Existing pathway: PHCC Annual Health Checks.[83]
PHCC breast,[79] bowel[80] and cervical[81] screening pathways: official service specifications. Qatar osteoporosis guidance: a published local consensus guideline.[82]	Align screening and fracture-risk referrals with these specific pathways before adding tests. These sources establish recommended practice, but do not demonstrate the effectiveness of a new combined longevity service.
PHCC-HMC Integrated Care for Older People (ICOPE) clinic collaboration. Official institutional report of service development, 2025.[100] HMC reports more than 2,074 assessments from January 2024 to October 2025; this is service activity, not yet evidence of effectiveness.[100]	Connect assessment, rehabilitation, home support and caregiver follow-up. WHO's ICOPE 2025 supports person-centered pathways;[24] the local announcement[100] is not yet a comparative evaluation of outcomes or equity, which could be initiated.
Center for Empowerment and Care of the Elderly (Ehsan) services for older people. Institutional description; evidence of an existing organization and service remit.[155]	Ministry of Social Development and Family (MSDF), Ehsan and health partners define social care referrals, eligibility and responsibility for unresolved needs. Care integration is supported by WHO guidance.[24] Consider outcome evaluation.

Verified Qatar foundation and source status	Evidence for proposed deliverables
Healthy City, Healthy Education City and Healthy University designations. Official announcement of recognized settings.[154]	Connect community, education and workplace prevention, and define reach and participation measures. WHO recommends population activity measures.[44] Qatar's physical-activity guideline informs local adaptation.[48] Physical activity should be measured to evaluate potential healthspan effects.
Qatar Precision Health Institute, Qatar Biobank and Qatar Genome. Institutional program information.[156]	Develop representative longitudinal research and implementation trials with appropriate consent and governance. NIH lifespan-inclusion policy[69] and International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) trial guidance[138] inform design.
MoPH health statistics and STEPwise survey. Official descriptive data from the Qatar Health Brief Report 2024.[51]	Agree definitions, denominators, quality checks and an outcome dashboard. WHO/United Nations Children's Fund (UNICEF) measurement framework provides indicator architecture;[159] proposed linkage and reporting arrangements have no direct program-effectiveness evidence.
WISH and international healthy longevity convening. Official event reporting demonstrates convening activity.[157]	Use this platform for independent evidence review and shared methods, with national delivery accountability. No direct evidence that convening itself improves population health.

Evidence key: Official strategies and institutional descriptions are highlighted as existing policy, organization or service. Proposed connections and deliverables are the report's recommendations. If no evidence is available, it is explicitly mentioned.

To co-ordinate the health programs outlined in Table 3, MoPH's proposed Healthy Longevity Initiative could provide a governance framework around health and functional outcomes across the life course. The proposed governance group should include PHCC, HMC, Ministry of Social Development and Family (MSDF), relevant education, municipal, sport, labor, finance, digital and data authorities, QPHI, academia, WISH, and service-user representatives, including people with disabilities. The group's initial task should be to identify existing services, coverage gaps, responsible institutions and costed actions. Each sector should retain its statutory responsibilities. The co-ordination role should include using research findings in adoption decisions, addressing transitions to adult services, follow-up after preventive assessment, and continuity between rehabilitation and community support.

MoPH should work with the Ministry of Commerce and Industry (MoCI) and other competent authorities to oversee healthcare and relevant health products. In current regulation, Qatar's consumer-protection law addresses misleading product and service information,[20] whereas MoPH provides registration of relevant

health products[21] and the Department of Healthcare Professions (DHP) sets healthcare-practitioner advertising requirements.[22] The new regulatory map should classify each product or service by intended use, claim and risk. Consumer and wellness products or services require substantiated claims and clear referral boundaries. Medical tests, medicines and procedures require the applicable medical oversight, including when delivered in a wellness setting. The allocation of regulatory duties should be published for public and private providers.

The proposed National Health Strategy's roadmap for 2026–2030 specifies governance, evaluation and service-delivery milestones. Its initial phase in 2026–2027 should establish governance arrangements, baseline definitions and a costed implementation plan, drawing on work already underway. During 2027–2028, the government should evaluate selected linked pathways in existing settings, with expansion conditional on access, benefit, safety, workload and cost. By 2030, effective components should be integrated into routine funding, records and workforce development. A longitudinal evaluation can test whether people sustain or recover function and participation, while recognizing changes in Qatar's resident population. Research on emerging gerodiagnostics and gerotherapeutics should have explicit milestones regarding clinical efficacy and regulatory qualifications.

4.3 AN INTEGRATED OPERATING MODEL FOR THE FRAMEWORK

Service levels matched to need and resources

Implementation of a national framework for integrating healthy longevity should begin with those health services that are effective and which health systems can deliver reliably: accessible primary care, essential medicines, indicated prevention, basic assessment of function and routes to rehabilitation and social support.[4,23,24] The government sets priorities, standards and public funding. Publicly or privately contracted providers deliver accountable care in conjunction with community organizations. Employers contribute health promotion within defined roles and workplace health and wellness programs. Additional diagnostics or specialist services should be commissioned only after demonstrating value and the capacity to act on results. Research budgets should be explicit so that experimental approaches do not displace established care.

Organ function and medical care coding

Healthcare services should record a patient's disease, organ function and functional abilities and individual care goals.[160] WHO's International Classification of Functioning, Disability and Health (ICF) offers an established framework for classifying functioning alongside disease through the International Classification of Diseases (ICD).[160] This report proposes interoperable recording of validated organ-function measures and consideration of medical care coding extensions through the appropriate classification processes. Integrated Care for Older People (ICOPE) supplies an operational model for the older generation. Younger adult and midlife pathways require suitable measures and validation.[24,77]

Individual patient care plans

A named primary-care clinician or team should be accountable for individual co-ordinated care plans, with specialist responsibility for referred problems.[23] Entry to the care pathway can occur through routine primary care, maternal and child services, school health, an eligible health check, a specialist or rehabilitation referral, or community identification of unmet need. Patient risk stratification should combine established disease and risk, symptoms, function, social circumstances and the person's goals.[24] A commercial biological-age score should not determine eligibility or treatment.[6]

The proposed care plan service model has three levels:

- Universal population support improves environments and access to prevention.
- Targeted primary care addresses identified risks or conditions through a shared plan.
- Co-ordinated specialist and rehabilitation care supports complex disease, disability or declining capacity.

Research participation is a separate route with appropriate consent and oversight. Services should offer face-to-face and non-digital access, language support and reasonable accommodation according to need. The care team should agree measurable goals, responsibilities and review timing with the person.[24] Nurses can co-ordinate follow-up, while physicians manage clinical decisions and pharmacists review medicines. Allied health and mental health professionals should address nutrition, movement, cognition, psychological and sensory needs.[24] Referral arrangements should specify how people obtain community support, rehabilitation, assistive products, home-based services and caregiver support.[9,24] Completed referrals should be documented, with clear confirmation of service access and delegated responsibility for subsequent care.[23,24]

The Community Aging in Place – Advancing Better Living for Elders (CAPABLE) randomized controlled trial in the US provides evidence for a defined home-based model combining nursing, occupational therapy and home modifications. The number of adults with self-care disability in activities of daily living (ADL) was lower at five months, but the between-group difference was not significant at 12 months.[73] This supports evaluation of co-ordinated home support. However, the complete proposed national care pathway requires local assessment.

Follow-up care should be proportionate to risk and change in need, with prompt reassessment after deterioration or an intervention likely to cause harm. Commissioners should measure unmet need, completed referrals, continuity, function, patient experience, workload and cost.[23,24] A minimum service can use established records and simple validated measures, whereas multidisciplinary and digital components should be added when staff, follow-up and funding are available. This staged model can be adapted to systems with constrained resources.

Community support linked to clinical care

Community organizations, schools, employers and municipalities can make health-promoting activities accessible, while consumer and wellness services support informed choices and sustained participation. Medical services retain responsibility

for clinical decisions and care plans. Referral agreements should define competence, eligibility, safeguarding and how information is shared with consent. Evaluation should assess access, continuity, outcomes and costs across childhood, adolescence, adulthood and later life, including people with a disability.[3,9,23]

Artificial intelligence and digital infrastructure

Digital infrastructure should support continuity across existing healthcare services. Health data measurements from validated telehealth devices measures may be added where they improve clinical decision-making and a responsible professional can act on the result.[71,103] Procurement of digital products should assess benefit, workload, accessibility and cost. Proposed governance requirements include a defined legal basis, appropriate consent, access controls, data minimization, retention limits, cybersecurity, documentation of algorithm changes and incident response. Non-digital routes should remain available so that people are not excluded from care if they lack digital literacy or do not own a device.

4.4 GLOBAL CO-OPERATION AND ACCOUNTABILITY

As well as the various national programs examined in Section 4.1, there are a number of global programs that are designed to promote integrated long-term healthcare and healthy aging. This section looks at some of the main global initiatives and opportunities for international co-ordination.

The United Nations Decade of Healthy Ageing

The United Nations Decade of Healthy Ageing 2021–2030 is a campaign to promote healthy individuals and communities. The initiative organizes action around ageism, age-friendly environments, integrated care and long-term care.[162] WHO's 2023 progress report about the United Nations campaign documents advances alongside uneven implementation and resourcing.[162] However, the campaign's focus on older people provides an important foundation for a future healthy longevity strategy. A healthy longevity strategy should also specify how national policies build and sustain capacity in younger and middle-aged adults.[3]

United Nations Human Rights Council

Human rights work provides a further route for international co-operation. In April 2025, United Nations Human Rights Council resolution 58/13 established an intergovernmental working group to elaborate a legally binding instrument on the human rights of older persons.[163] Its eventual obligations will depend on the instrument adopted and states' participation.[163] National healthy longevity policy should incorporate participation, non-discrimination and access throughout the life course.[66]

International co-ordination and institutional responsibilities

A coherent global strategy requires complementary contributions from health, economic, labor and development institutions. This report proposes shared measurement principles, co-ordination of research infrastructure and transparent

reporting of implementation. WHO can support health and functional measurement, whereas economic institutions can assess participation and fiscal implications and national governments should define accountable delivery and budgets.[3,10,162]

The same co-ordination is needed in education. Decisions about healthy longevity are made across ministries, regulatory bodies, health systems, employers, investors and communities. Section 4.5 proposes competencies that connect scientific evidence with these decisions.[3]

4.5 WORKFORCE EDUCATION AND COMPETENCE ACROSS SECTORS

Workforce development should support established prevention, functional assessment, co-ordinated care, disability inclusion and evidence appraisal. National assessments should record workforce capacity and demonstrated competence, with assessment of readiness for clinical practice in addition to course attendance. This section discusses the available educational study and a proposed competency framework.[161]

The health education sector should develop the competencies required to apply health promotion evidence in policy, clinical care, research and public decision-making. A co-ordinated program should develop competence in established prevention, functional assessment, accessibility and evidence appraisal, with specialist training for emerging geroscience applications.[3,5,24]

Curriculum and workforce reviews should identify what is already taught, how competence is assessed and where gaps affect delivery. Training should cover age-appropriate care throughout life, and continuity between services.

A competency framework for health professionals

A cross-sectional survey of 113 physicians who completed accredited healthy longevity medicine courses examined implementation intentions and self-reported confidence.[161] The results support further educational evaluation but do not establish representative training coverage or patient benefit. Prospective assessment should test knowledge, professional behavior and clinical outcomes.[161]

A tiered model can match competencies to professional roles.

Healthcare professionals

The following foundation competencies are proposed for healthcare professionals:

- Normal heterogeneity of aging and the difference between chronological age, biological processes, disease, frailty and disability.[2,5,98]
- Health promotion across the life course, with prevention contributing to sustained health and capacity.[3,19]
- Assessment of intrinsic capacity, function, cognition, mood, sensory impairment, nutrition, mobility and social context.[24]
- Multimorbidity, polypharmacy, medication review and deprescribing.[24]

- Exercise, nutrition, sleep and vaccination with practical guidance appropriate to age and health status.[2,24,44,99]
- Shared decision-making based on absolute benefit, time to benefit, treatment burden and individual goals.[23,24]
- Recognition and reduction of ageism.[66]
- Communication that preserves agency and avoids deterministic language.[6,9]

Advanced competencies for geromedicine

For clinicians delivering precision geromedicine, advanced competencies should include:[5,6]

- Critical interpretation of molecular, imaging and digital gerodiagnostics.
- Appraisal of evidence for repurposed medicines, nutraceuticals and emerging gerotherapeutics.
- Exercise prescription and referral for people with different levels of function.
- Trial eligibility, informed consent, adverse-event monitoring and registry participation.
- Integration of results with primary care, specialist care and rehabilitation.
- Evaluation of clinical utility, cost-effectiveness and equity.
- Management of conflicts of interest and commercial claims.

Education for industry, investors and health-system leaders

Investors and executives should be able to distinguish a validated clinical endpoint from a proprietary score, an exploratory signal from a regulatory claim, and commercial market projections from demonstrated clinical benefit. Education should include evidence standards, realistic development timelines, post-market obligations, representative recruitment and the costs of integration into care.[5,6]

Health system leaders need operational training in longitudinal care, financing health promotion, digital procurement, multidisciplinary work and the evaluation of service value. They should be able to allocate resources for assessing workload, and discontinue services with an unfavorable balance of benefit and cost. Procurement decisions should require evidence that a test improves the intended decision and outcome, with prognostic associations assessed as one part of that evidence.[6,23]

Public, patient and media literacy

Public education should use accessible, multilingual and disability-inclusive communication, co-designed with communities and people who use the healthcare services. Materials should describe the intervention or service, studied outcomes, uncertainty, costs and relevant regulatory status, using formats such as plain language, audio, captions and easy-read materials where needed. Comprehension and decision quality should be evaluated.

Education should accompany practical measures that make healthy choices feasible, including affordable services, accessible environments, time and social support.[9,11]

Core public questions include:

- What outcome was studied: a laboratory value, function, disease, disability or survival?
- Was the evidence from cells, animals, observational data or a randomized human trial?
- Was the population similar to the person considering the intervention?
- What was the absolute benefit and over what period?
- What harms, costs and alternatives were assessed?
- Is the intervention approved for this purpose?
- Will the provider share results with the person's regular clinician and report adverse events?

Journalists and science communicators also need access to independent briefing materials. Media coverage should avoid converting animal lifespan extension into a human treatment claim, reporting relative risk without absolute risk, or describing any change in a biological age as 'rejuvenation'. Expert declarations of interest and the regulatory status of a product should be routinely reported.[6]

Updating evidence and continuing education

Curricula and living evidence summaries should routinely include the same use-specific implementation decisions as Table 2: implement established uses; evaluate investigational human applications; continue preclinical research; or do not offer unsupported or unfavorable uses. Classification should state the intended population, use, outcome and date. An independent review group should assess new evidence and update training, clinical guidance, commissioning and public communication when classification changes.[5,6] Competence includes implementing effective care, recognizing uncertainty and correcting unsupported claims. Training should distinguish these implementation categories from study design, recommendation strength and certainty of evidence.

4.6 FUTURE RESEARCH AND IMPLEMENTATION

Future research should support national decisions while contributing to longer-term scientific progress. The proposed priorities for Qatar include governance, service evaluation, workforce development and baseline measurement within the 2026–2030 planning cycle. However, new biomarker discovery and gerotherapeutic efficacy depend on research results and regulatory assessment and may extend beyond 2030.

Table 4 shows possible measurements, sources of evidence and proposed reporting for accountability.

Table 4. Measurement choices, evidence sources and proposed reporting

Measurement domain	Operational measures and evidence basis	Proposed accountability and interpretation
Population health and inequalities	Life expectancy and healthy life expectancy, with method, year and uncertainty. Disease burden and distribution by relevant population groups. WHO defines healthy life expectancy;[12] other healthspan definitions vary.[26] The *Qatar Health Brief Report* supplies national descriptive data.[51]	MoPH and statistical custodians publish comparable estimates when valid updates are available. Descriptive/modeled population evidence. Changes cannot be attributed to this program without a suitable evaluation design.
Development, function and disability	Use age-appropriate early-development measures;[7] gait/chair-stand or muscle strength where appropriate;[98] ICOPE domains for older adults;[24] WHO Disability Assessment Schedule (WHODAS 2.0) for adult disability and participation.[168] Report instrument, scoring, language and missing data.	PHCC, HMC and social care partners select a small common set. Instrument/consensus evidence supports measurement, not a single lifespan score. Validate language, mode and population fit. Use age appropriate scales.
Access, continuity and equity	Eligible population, invitations, take-up, completed referrals and retention; record access barriers and disaggregate by age, sex, disability and relevant residence/eligibility groups where lawful and feasible. Indicator framework: WHO/UNICEF.[159]	Quarterly operational review and annual public reporting, with privacy safeguards. Numerator/denominator definitions and subgroup completeness are mandatory local design choices.
Clinical effectiveness and safety	Indication-specific risk control and outcomes, adverse events and discontinuation. Hypertension,[87] chronic kidney disease[92] and osteoporosis[82] guidance inform appropriate clinical monitoring. Research adds prespecified outcomes and safety reporting.[138]	Clinical leads use condition-appropriate follow-up and risk adjustment. Do not impose one annual retesting schedule on every test or treatment. Program attribution requires a comparator or credible quasi-experimental design.
Experience, workforce and value	Patient-reported experience, workforce capacity, service costs and financial barriers, using a documented collection method. WHO/UNICEF provides a health system measurement framework.[159]	Commissioners combine these with clinical benefit and equity in annual review. Local measures and cost assumptions require validation.

Quality assurance

Quality assurance should include standardized instruments, training, range and consistency checks, audit of missing data and changes in definitions, and independent analytical review. Where valid, results should be stratified by age, sex, disability or functional limitation, nationality or residency, socioeconomic position and geography. Migration and loss to follow-up require explicit analyses as a change in the resident population should not be mistaken for an intervention effect.

Data linkage should have a defined legal basis, clear custodians, access controls, data minimization, appropriate consent arrangements and privacy-preserving methods. Research access and public reporting should be governed separately, with aggregate reporting that protects small groups. Digital procurement should document interoperability and algorithm changes.[71] MoPH should seek alignment with relevant Gulf Cooperation Council (GCC) indicator work after confirming its remit, definitions, ownership and development status; alignment should be contingent on verification of the relevant GCC arrangements.

The proposed national scorecard should separate long-term population outcomes from annual program indicators. Independent evaluation should test whether phased delivery improves outcomes beyond civil society trends, with prespecified equity and value analyses. National leadership should review findings annually and publish decisions to expand, adapt or discontinue programs.

SECTION 5. CONCLUSION AND POLICY RECOMMENDATIONS

A national healthy longevity strategy should establish measurable objectives for health, functional ability, wellbeing and equitable participation across the life course.[2,3] Implementation should prioritize established population-health interventions, prevention and clinical care, supported by co-ordinated education, employment, housing, financing and social-protection policies.[4,19] Emerging applications of precision geromedicine should be combined with primary healthcare, but only after evaluation against defined clinical outcomes, safety, costs and incremental benefit.[5,6]

For Qatar, the proposed framework informs the development of MoPH's Healthy Longevity Initiative through evidence-based priority setting, institutional accountability and independent evaluation, aligned with the National Health Strategy 2024–2030.[16]

The 2026–2030 planning cycle provides a basis for co-ordinating existing programs, defining institutional responsibilities and allocating resources for phased implementation of a national healthy longevity strategy. Adoption and expansion of individual programs into the framework should depend on demonstrated benefit, equitable access, safety, workforce capacity and affordability. National monitoring of the framework should include reporting population outcomes and program performance separately, with published decisions on continuation, adaptation or discontinuation.

RECOMMENDATIONS

This report proposes eight recommendations for healthcare policymakers, and provides an implementation matrix to translate these into suggested responsibilities, deliverables, milestones, resource requirements and reporting. National authorities should confirm institutional ownership and budgets before adoption.

1. Make health promotion across the life course a shared national objective

A life-course objective should be adopted in healthcare, spanning preconception, childhood, adolescence, adulthood and later life.[2] Established prevention and care should be connected with policies that support health, function, wellbeing and participation.[3,19] In Qatar, this work should be aligned with the National Health Strategy 2024–2030[16] and the MoPH's proposed Healthy Longevity Initiative.

Existing health and wellbeing programs and budgets should be mapped across health, education, municipalities, sport, labor and social development. Priorities for expansion into longevity health should be chosen by assessing burden, effectiveness, equity and delivery capacity. Population policy and environmental measures should remain prominent alongside individual services.[4,167]

2. Connect social policy equity and disability inclusion

Housing, workplace, education, financial security and care services should be co-ordinated to support participation in healthy longevity across the life course,[3] with protection for people unable to continue employment. Policy concerns requiring national evidence include a review of pension adequacy, interrupted contribution histories, protection for workers outside contributory schemes and the distribution of unpaid care.[61] Retirement products, savings, insurance and long-term care financing should be reviewed for their suitability to longer lives, changing health and interrupted working or caring histories.[3,61] Health policies should include lifelong and acquired disability, accessible services, assistive products, rehabilitation and caregiver support.[9] Policies should also connect social protection, disability inclusion, education, employment, housing and healthy environments to address barriers to prevention and participation. In Qatar, health pathways must be linked with the Ministry of Social Development and Family (MSDF) and relevant community organizations, in accordance with applicable eligibility criteria.

3. Strengthen integrated healthy longevity care

Existing primary and specialist care pathways, rehabilitation and community services should be used to provide age-appropriate and geroscience-informed assessment, shared plans, indicated intervention and follow-up.[23] The World Health Organization's (WHO's) Integrated Care for Older People (ICOPE) guidance can inform care pathways for the older population.[24] The healthcare sector should publish eligibility, service levels, care-plan ownership and referral responsibilities. The sector should pilot and evaluate new components, including precision geromedicine, when evidence or a justified research question supports additional value.[5,6]

4. Establish data and monitoring as national infrastructure

There should be a national infrastructure for healthspan, functional ability, quality of life, participation, program delivery and inequalities, with agreed baseline estimates, standard definitions, denominators, sources, responsible custodians and reporting frequency. The government should report long-term population outcomes, functional and lived-experience measures, and annual program performance separately (see Table 4). Quality assurance should be undertaken. And, with patients' privacy preserved, equity and value analyses should be published. Relevant Gulf Cooperation Council (GCC) developments must be confirmed before regional definitions are aligned. Instrument- and condition-specific follow-up should accompany quarterly management review and annual public reporting at proposed governance intervals, not evidence-based schedules for repeating every clinical test.[159]

5. Develop competence and public understanding

There should be clear information for communities and the public, and practical competencies among healthcare professionals, policymakers, regulators and industry. Workforce and curriculum gaps should be assessed and role-appropriate training funded in established prevention, function, disability inclusion, co-ordinated care and evidence appraisal.[169] Advanced geroscience and regulatory training should be provided where relevant.[5] The longevity-education survey supports further evaluation; it does not establish patient benefit.[161] Accessible multilingual public

communication should be designed to include policymakers, regulators, industry, health-system leaders and journalists. Comprehension, decisions and practice should be evaluated alongside measures that make healthy choices feasible.[9,11]

6. Co-ordinate research and evidence pathways

Evaluation should include longitudinal cohorts, implementation studies and trials of emerging approaches. Population health, longitudinal, implementation and translational research should be joined up. Implementation decisions should be based on separate outcome-specific certainty, with evidence requirements specific to population, intended use and outcome.[5,6] Regulators and health-technology assessment bodies should be engaged early to support appropriate trials, independent replication, representative recruitment and long-term safety monitoring.[138] Established service budgets must be protected while making research commitments transparent.

7. Clarify standards and regulatory responsibilities

Proportionate standards should be applied to medical care, consumer and wellness products, and services. There should be clear accountability for claims, safety and follow-up. The responsibilities that apply to consumer and wellness products or services, and medical care, should be published based on intended use, claim and risk. In Qatar, MoPH should co-ordinate relevant health sector regulation with the Ministry of Commerce and Industry (MoCI) and other competent authorities.[20–22] Regulators should require all claims to be substantiated, professionals to have appropriate competence, transparent uncertainty, privacy safeguards, and clear referral and adverse-event reporting arrangements.[6,71]

8. Fund phased implementation and independent evaluation

The government should agree a costed roadmap for the National Health Strategy's roadmap for 2026–2030, with accountable leads and resources for workforce time, accessibility, data quality, follow-up and evaluation. Established health interventions should be expanded according to need and capacity. Investigational human applications should be evaluated through research, and preclinical work should be retained in program development. Independent assessment of benefit, harm, equity, workload and cost should determine scale-up, adaptation or discontinuation. Milestones should be published and independent evaluation commissioned before wider adoption. Funders should co-ordinate investment in biomarkers of aging, clinical trials, long-term follow-up and implementation, with transparent reporting.

IMPLEMENTATION MATRIX FOR RECOMMENDATIONS

Table 5 translates the eight recommendations into a proposed implementation matrix. Each row distinguishes the supporting policy, guideline or study from the unevaluated delivery arrangement. All suggested leads, dates, resources and reporting commitments require national agreement. Resource descriptions are planning assumptions rather than cost estimates. Each lead should prepare a local business case and a separately identified evaluation budget.

References support the underlying policy, clinical component, research standard or measurement approach but they do not validate the complete implementation matrix.

Table 5. Proposed implementation matrix: Responsibilities, milestones and evidence

Priority and proposed lead	Proposed first deliverable	Proposed timing	Proposed resource needs	Evidence basis and evaluation
1. Make health promotion across the life course a national objective: Ministry of Public Health (MoPH) with national partners.	Map existing commitments and service gaps and agree a costed roadmap. Strategic alignment: National Health Strategy 2024–2030.[16]	2026 planning; annual review. Proposal, not an adopted deadline.	Co-ordination and analytical staff, explicit program and evaluation budgets. Local costing required.	Official policy basis National Health Strategy 2024–2030.[16] No direct evaluation of this proposed roadmap. Report agreed responsibilities, funded coverage and unmet needs.
2. Connect social policy equity and disability inclusion: Ministry of Social Development and Family (MSDF), MoPH and relevant labor, education and municipal partners.	Define accessible entry routes, eligibility and responsibility for completed social/clinical referrals.[9,72]	2026–2027 design; 2027–2028 phased delivery. Proposed.	Accessible communication, interpretation, transport/outreach and caregiver support, cost locally.	WHO disability-equity and assistive-technology guidance.[9,72] Community Aging in Place – Advancing Better Living for Elders (CAPABLE) randomized controlled trial supports a specific disability intervention,[73] not the entire equity model. Proposed measures: eligible reach, access gaps and completed referrals.
3. Strengthen integrated healthy longevity care: Primary Health Care Corporation (PHCC) and Hamad Medical Corporation (HMC).	Test a named care co-ordinator, shared plan and referral follow-up at selected sites. Existing local Integrated Care for Older People (ICOPE) service.[100] World Health Organization (WHO) pathway guidance.[24]	2027–2028 evaluation. Consider expansion by 2030. Proposed.	Primary-care time, rehabilitation, referral capacity and patient follow-up, assess capacity before scale-up.	Practice guidance and local service description.[24,100] No direct evidence for this exact delivery package. Evaluate function, risk control, safety, workload and access against a defined baseline or comparator.

Priority and proposed lead	Proposed first deliverable	Proposed timing	Proposed resource needs	Evidence basis and evaluation
4. Establish data and monitoring as national infrastructure: MoPH and relevant data custodians.	Agree an indicator dictionary, baseline, data-quality checks and a public scorecard. Framework: WHO/UNICEF Primary Health Care Measurement Framework and Indicators.[159]	2026 baseline design; annual reporting when data permit. Proposed.	Data stewardship, quality assurance, linkage governance and analytical capacity, cost locally.	International measurement framework,[159] not causal evidence of benefit. Proposed reporting: completeness, subgroup coverage, missing data and independent quality review.
5. Develop competence and public understanding: education bodies, employers and relevant accreditation bodies.	Map role-specific needs; assess competence in evidence appraisal, person-centered care and communication.[169]	2026–2027 needs review, 2027–2030 delivery. Proposed.	Protected training time, supervision, accessible materials and assessment; cost locally.	WHO competency framework.[169] Longevity-training study is cross-sectional self-report,[161] not proof of better patient outcomes. Evaluate observed practice and service quality as well as knowledge.
6. Co-ordinate research and evidence pathways: Qatar Precision Health Institute (QPHI), universities, clinical partners and funders.	Register protocols, prespecify patient-relevant outcomes, obtain ethics and regulatory review and plan transparent reporting.[138]	2027–2030 staged studies and ongoing safety review. Proposed.	Research staff, monitoring, long-term follow-up and independent analysis, separately cost research.	International Council for Harmonisation (ICH) E6(R3) principles and Annex 1, final January 2025:[138] international research standard, not evidence of treatment efficacy or automatic Qatar adoption. Report recruitment, harms, results and progression or deciding to stop.
7. Clarify standards and regulatory responsibilities: MoPH, Ministry of Commerce and Industry (MoCI) and other competent authorities.	Map relevant legal responsibilities and establish a process for assessing products, indications and claims.[20–22]	2026–2027 design; continuing review. Proposed.	Clinical/regulatory expertise, inspection and complaint handling; cost locally.	Applicable legal sources[20–22] establish obligations, biomarker consensus[6] informs evidentiary appraisal. The proposed enforcement workflow is unevaluated. Report substantiation decisions and safety signals.
8. Fund phased implementation and independent evaluation: MoPH, finance partners and independent evaluators.	Prepare costed business cases and prespecified adoption, adaptation and stopping criteria.[158,159]	2026–2027 budget design, 2028 and 2030 review points. Proposed.	Dedicated evaluation resources plus service budgets; no cost or savings estimate without local inputs.	Gulf Cooperation Council (GCC) economic evaluation is model-based,[158] not an observed return from this roadmap. The WHO/UNICEF Primary Health Care Measurement Framework and Indicators[159] supports evaluation structure. Compare benefits, harms, equity, costs and opportunity costs.

Independent evaluation should be commissioned by national governance groups and undertaken by a team with declared interests and access to agreed data. A protocol should be published before expansion of the agreed health programs. Outcomes, harms, equity, opportunity costs and implementation fidelity should be assessed. The 2028 review should inform decisions on expansion, adaptation or discontinuation of services. The 2030 review should inform recurrent funding and sustained integration. Scientific efficacy milestones should be reported separately from service delivery milestones.

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DISCLAIMER

This report reflects the research and analysis of the authors. It does not represent the policy of the Ministry of Public Health.

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APPENDIX. TECHNICAL EVIDENCE ON BIOMARKERS AND INTERVENTIONS

A1. BIOMARKERS AND ASSESSMENT REQUIREMENTS

Clinical and functional measures

Intrinsic capacity provides a framework for assessing physical and mental capacities and their change over time.[2] The World Health Organization (WHO) framework includes cognition, locomotion, vitality, psychological capacity and sensory capacity.[2] Domain measures can guide assessment, while a global score requires validation for its intended purpose.[77] Alternatives or complements include organ-specific function, patient-reported health, disability-free survival and disease-event outcomes.[77] Selection should reflect the population and the decision.[77]

WHO's Integrated Care for Older People (ICOPE) guidance operationalizes assessment in older people.[24] Its instruments and thresholds require age-appropriate validation before extension to younger and middle-aged adults.[77] Grip strength, mobility and fitness should likewise be selected for the capacity being assessed, with attention to measurement error, change over time and floor or ceiling effects.[24,77] Interpretation of functional measures requires consideration of clinical and environmental factors. Acute illness, pain, mood, medicines, environmental barriers and chronic disease may all affect performance.[2,24] Assessment should lead to appropriate investigation and an individual care plan.[24]

Biological biomarkers of aging and biological age algorithms

Biological age algorithms combine measurements to estimate an aging-related state or trajectory.[6] Some use routine laboratory data; others use DNA methylation, proteins, metabolites or other molecular features.[6] First-generation epigenetic clocks predicted chronological age.[6] Later approaches, including GrimAge and DunedinPACE, were developed around mortality-related information or longitudinal physiological change.[106,107] Their interpretation depends on the outcome and population used in development and validation.[6]

Three questions should guide interpretation:

- **Causal relevance:** An association between biomarker change and outcome change does not establish that the biomarker mediates treatment benefit. Causal questions require an appropriate design and analysis; prediction and surrogate-endpoint qualification are separate tasks.[6]
- **Clinical utility:** Determine whether using the result improves decisions beyond established assessment.
- **Surrogate-endpoint validity:** Demonstrate that treatment effects on the biomarker reliably predict treatment effects on a specified clinical outcome.

Epigenetic and other molecular clocks are useful research tools. Routine clinical use requires evidence on reproducibility, reference populations, uncertainty, added information, actionability and cost-effectiveness.[6] Trial sponsors should agree the proposed context of use with regulators, health-technology assessment bodies, payers or commissioners, and patients before committing to large validation programs. The plan should specify acceptable endpoints, the data required for qualification and criteria for stopping development when a test cannot improve a clinical decision. Regulatory advice informs development and does not guarantee eventual qualification.[6,77,78]

Organ-specific and multi-omic measures

Proteomic studies show that organs can have different aging-related signatures within the same person. These signatures are associated with subsequent disease and mortality.[105,170] UK Biobank analyses using clinical, physiological and imaging data also identify heterogeneous aging across organ systems.[104] Such measures may support more precise research stratification.[104,105,170] Routine use should be supported by evidence of incremental clinical utility.[6]

Digital biomarkers of aging

Digital biomarkers of aging use objective, quantifiable signals collected through digital devices to characterize aging-related physiological or behavioral features.[103] Wearables, smartphones and home sensors can provide repeated observations between clinical visits.[103] Their additional value should be established against existing assessment, with device-specific validation and interpretable action thresholds.[6,103]

Within the combined consumer and wellness pathway, devices can support self-monitoring and programs can use measurements to guide defined activities. Providers should explain accuracy, uncertainty, privacy and referral boundaries.[71,103] Medical use requires a validated clinical purpose and a named professional responsible for review and follow-up.[6,103] The US Food and Drug Administration's (FDA's) 2026 general-wellness guidance is a US example limited to low-risk devices promoting healthy lifestyles; it does not govern services, supplements or Qatar's markets.[171]

The clinical-utility standard

For clinical assessments, the report proposes six requirements drawn from biomarker-validation literature and the objective of equitable value. Consumer and wellness providers should substantiate the specific claims made; using a result to direct medical care requires evidence of clinical utility for that application.[6]

- **Analytical validity:** Measures the signal accurately and reproducibly.
- **Clinical validity:** Predicts a defined outcome in the intended population.
- **Incremental value:** Improves on simpler, established measures.
- **Actionability:** An evidence-based response exists for an abnormal result.

- **Clinical utility:** Acting on the result improves outcomes or reduces harm.
- **Equity and value:** Performance is consistent across populations and benefits justify financial and opportunity costs.

A national gerodiagnostic assessment pathway

Governments should use a staged pathway for commissioning clinical assessments and additional biomarkers, proportionate to need and available resources.

The following proposals connect validation with an explicit health objective and defined responsibility for interpretation, clinical decisions and follow-up.[6,23]

Step 1: Define the intended population, health objective and decision capacity. Commissioners should specify whether a test supports assessment of capacity, health optimization, prevention, diagnosis, treatment selection or research, and which outcome its use should improve.[5,6]

Step 2: Establish a clinical foundation. Use history, medicines review, examination and age-, sex- and risk-appropriate assessment. Blood-pressure,[87] lipid,[88] glucose[90] and kidney[92] testing should follow the relevant guidance and national screening policy. Qatar's cancer-screening pathways[79–81] and fracture-risk guidelines[82] provide local specifications; confirm current institutional hypertension and lipid protocols before implementation.

Step 3: Measure capacity longitudinally. Select a feasible data set of physical, cognitive, psychological and sensory measures with validated norms for the intended population. Pilot younger-adult and midlife pathways separately from instruments developed for older populations.[24,77]

Step 4: Evaluate additional tests. Require independent validation and comparative assessment of whether digital or biological biomarkers improve decisions, outcomes and value. Research pathways should specify how exploratory results are communicated.[6,103]

Step 5: Define action and oversight. Medical services should connect results with evidence-based clinical decisions and follow-up. Within the consumer and wellness pathway, product sellers should substantiate claims, and service providers should define competence, scope and referral arrangements. Clinical interpretation belongs within the medical pathway. These are proposed operational responsibilities, applied within the relevant national requirements.[6,20–22]

Step 6: Monitor a feasible core of outcomes. In all settings, prioritize symptoms, function, treatment safety, access and essential service delivery using existing records where possible. Add quality of life, patient experience and costs as capacity permits. Biological-age tests, multi-omic panels and intensive digital monitoring require separate evidence and funding.[6,23] Procurement should specify staff time, follow-up capacity and the opportunity cost before expanding assessment.

Proposed reporting standards for biomarkers of aging

For aging biomarker tests offered as consumer products, within wellness services or in medical care, this report proposes disclosure of the following information, adapted to the intended use from biomarker-validation principles:[6]

- The biological material, assay platform and algorithm version.
- Whether the model predicts chronological age, mortality, disease, function or pace of change.
- The population in which it was trained and independently validated.
- Technical and within-person variation, including an uncertainty interval.
- Sensitivity to acute illness, smoking, cell composition, medication and sample handling.
- Incremental performance beyond established risk and functional measures.
- Whether the result has been prospectively shown to improve a clinical decision.
- Conflicts of interest and whether the laboratory or clinician profits from the recommended intervention.
- A clear statement when the test is not approved or validated to direct treatment.

Reports should identify the intended user, setting, age range and validated claim, and explain how uncertainty affects interpretation. Product information and wellness programs should specify the limits of self-monitoring and routes to professional assessment. Medical reports should identify the clinical decision a test is intended to improve. Procurement should establish whether that use improves an agreed outcome at an acceptable cost.[6]

A2. MEDICINES AND INVESTIGATIONAL APPLICATIONS

GLP-1 receptor agonists have demonstrated cardiovascular,[112] kidney[113] and specified liver histological benefits[172] for particular agents and patient groups. These outcomes support further research on broader healthy longevity effects.[173] Recent debate in *Nature Aging* considers their possible gerotherapeutic role,[173] while a 2026 study reported lifespan extension with late-life semaglutide treatment in female mice.[174] Human trials should test organ-specific responses and clinical outcomes alongside validated aging biomarkers.[5,6]

SGLT2 inhibitors improve kidney[93] and heart-failure[115] outcomes in several patient groups, including some people without diabetes. These findings show the value of assessing medicines across organ systems, while preserving the eligibility criteria and benefit–risk assessment established in trials.[93,115] Geroscience research should investigate which mechanisms and patient characteristics account for benefit and test whether effects extend to additional outcomes.[5,164] This requires prospective assessment of health and function, with transparent reporting of harms.[5,164]

Evidence from major randomized trials

Repurposing approved medicines can draw on existing knowledge of manufacturing, pharmacology and common adverse effects.[137] Development for a new population or outcome still requires direct evidence of efficacy and safety.[137] An acceptable medicine for a person with established cardiovascular disease may have an

unfavorable balance in a healthy older person with a low absolute risk.[134,135] Polypharmacy, renal function, competing mortality, time to benefit and individual treatment goals become increasingly important with age.[137] Trials can assess treatment effects on clinically important events, preservation of function and survival free of dementia and disability. Two large Australian programs, Aspirin in Reducing Events in the Elderly (ASPREE) and Statin Therapy for Reducing Events in the Elderly (STAREE), illustrate how such outcomes can support clinical decisions.[89,134]

Aspirin and the evidence from ASPREE

Aspirin has anti-platelet and anti-inflammatory effects and was long considered a plausible intervention for the prevention of cardiovascular disease and cancer.[135,175] ASPREE randomized 19,114 community-dwelling older adults without cardiovascular disease, dementia or independence-limiting physical disability to 100 mg aspirin or placebo.[134,135,175] After a median of 4.7 years, aspirin did not prolong survival free of dementia or persistent physical disability.[134] It did not reduce cardiovascular events and increased major hemorrhage.[135] All-cause mortality was also higher in the aspirin group during the trial, largely because of cancer-related deaths, although this was an unexpected finding and required longer follow-up.[175]

The ASPREE-XT extension provides longer-term evidence. Across in-trial and post-trial follow-up there was no long-term reduction in major adverse cardiovascular events, while major hemorrhage remained more frequent among those originally assigned aspirin.[176] Follow-up approaching a decade found no reduction in overall or colorectal cancer incidence. Cumulative cancer mortality remained higher in the aspirin group (hazard ratio 1.15; 95 percent confidence interval 1.03–1.29), although the excess did not persist as a separate post-trial legacy effect.[177] Aspirin should therefore not be initiated routinely as a longevity intervention in healthy older adults; prescribing should follow indication-specific cardiovascular guidance.[134–136]

ASPREE also established a model for geroscience trials: recruit people initially free of major disease and disability; use a composite that includes death, dementia and persistent physical disability; adjudicate events; and continue observational follow-up after treatment stops.[134,176,177] The study demonstrates the value of testing biological plausibility against patient-relevant clinical outcomes.[134]

Statins and cardiovascular prevention

STAREE was a randomized trial of 9,971 Australian adults aged at least 70 years without cardiovascular disease, diabetes or dementia, assigned to atorvastatin 40 mg or placebo. Over a median 5.9 years, major cardiovascular events occurred in 297/4,984 versus 412/4,987 participants, respectively (hazard ratio 0.70; 95 percent confidence interval 0.61–0.82). The composite of death, dementia or persistent physical disability occurred in 637 versus 676 participants (hazard ratio 0.94; 95 percent confidence interval 0.84–1.05), without a statistically significant benefit. Serious adverse events occurred in 2.7 percent of each group; musculoskeletal, hepatobiliary and diabetes-related adverse events were more common with atorvastatin.[89]

Atorvastatin reduced cardiovascular events in the STAREE population, while the trial did not demonstrate an improvement in disability-free survival over the observed period.[89] The findings support individual cardiovascular risk assessment.[89] Longer follow-up and the US PREVENTABLE program can clarify effects on cognition, disability and survival.[178] Each endpoint should remain explicit when assessing the contribution to healthy longevity.[89,178]

Metformin and clinical translation

Metformin is an established treatment for type 2 diabetes and a candidate for repurposing because of its metabolic and cellular effects.[5,91] Its contribution to healthy longevity requires direct evaluation in the intended population.[5] Metformin prevents or delays type 2 diabetes in some high-risk adults, although intensive lifestyle intervention was more effective in the Diabetes Prevention Program.[91] Evidence for broader effects on aging remains under investigation.[5] In the 2025 MET-PREVENT randomized trial, 72 adults with a mean age of 80 years and probable sarcopenia plus pre-frailty or frailty received metformin or placebo for four months.[118] Metformin did not improve gait speed, was poorly tolerated, and hospital admissions were more frequent in the metformin group, although the small trial was not designed to establish effects on hospitalization.[118] These findings apply to the frail older population studied.[118] In the MASTERS trial, metformin attenuated muscle hypertrophy during resistance training in older adults; differences in strength gains were not statistically significant.[179] A separate randomized aerobic-training study found attenuation of selected mitochondrial and cardiorespiratory adaptations.[180] These interactions should inform the design of combined medicine and exercise interventions.[179,180]

Composite-outcome research extends across several programs. ASPREE[134] and STAREE[89] assessed disability-free survival; PREVENTABLE is designed around death, dementia and persistent disability;[178] and ARPA-H PROSPR is developing measurement and trial approaches for healthspan.[60] Metformin research should likewise specify the clinical outcomes, population and mechanisms under study.[5]

SGLT2 inhibitors

Cardiovascular and renal outcomes in defined populations. SGLT2 inhibitors were developed to lower glucose by increasing urinary glucose excretion.[92,93] Large trials subsequently demonstrated reductions in heart-failure hospitalization and progression of chronic kidney disease across several populations, including some people without type 2 diabetes.[93,115] Their effects across cardiovascular and renal outcomes make them relevant to geroscience research.[5] Use should follow the populations and indications supported by trials.[93,115] Safety assessment includes genital infections, volume depletion and ketoacidosis, with appropriate attention to renal function and perioperative management.[92] Trials of broader healthy longevity effects should measure function and multi-organ outcomes alongside safety.[5,164]

GLP-1 receptor agonists and related incretin therapies

In SELECT, major cardiovascular events occurred in 6.5 percent with semaglutide and 8.0 percent with placebo among adults with overweight or obesity and established cardiovascular disease, without diabetes (hazard ratio 0.80; 95 percent

confidence interval 0.72–0.90; mean follow-up 39.8 months).[112] FLOW demonstrated kidney benefit in type 2 diabetes with chronic kidney disease.[113] ESSENCE demonstrated improvement in specified liver histological outcomes in metabolic dysfunction-associated steatohepatitis.[172] Each trial addresses a defined population and endpoint.[112,113,172] These findings justify a research program linking organ-specific biomarkers with muscle strength, physical performance, cognition, treatment persistence and long-term function.[173] Clinical programs should evaluate nutrition and muscle function during weight loss and provide appropriate exercise support.[114] Safety, affordability and sustained access will influence population value.[114] Broader gerotherapeutic claims should be tested prospectively.[173]

Blood-pressure treatment

SPRINT demonstrated that more intensive systolic blood-pressure treatment reduced cardiovascular events and mortality in selected adults at increased cardiovascular risk, with increased rates of some adverse events.[111] Appropriate targets therefore require reliable measurement, monitoring and individual benefit–risk assessment.[111]

Anti-inflammatory medicines

In LoDoCo2, low-dose colchicine reduced cardiovascular events in patients with chronic coronary disease.[181] In CANTOS, canakinumab, an interleukin-1ß antibody, reduced recurrent cardiovascular events at the effective dose in selected patients with previous myocardial infarction and raised inflammatory markers, while increasing fatal infection.[166] These studies support pathway-based research with explicit attention to population and safety.[166,181]

Bone-active treatments

Randomized evidence shows that zoledronate can reduce fractures in older women with osteopenia.[94] Fracture prevention is a clinically meaningful contribution to healthy longevity.[94] Its implementation should follow assessment of fracture risk, contraindications and individual circumstances.[94]

Rapamycin and rapalogs

Inhibition of the mechanistic target of rapamycin (mTOR) pathway extended lifespan in genetically heterogeneous mice.[75] A systematic review of human studies identified signals in selected physiological outcomes alongside substantial gaps in evidence.[119] In the 2026 RAPA-EX-01 trial, 40 adults aged 65–85 received weekly sirolimus or placebo alongside exercise for 13 weeks.[120] The primary intention-to-treat analysis found no statistically significant difference in chair-stand improvement; sensitivity analyses suggested attenuation, and the total adverse-event burden was higher with sirolimus.[120] Dose, schedule, patient selection and interaction with exercise need further evaluation.[120]

Across repurposed medicines, assessment should specify the intended population and outcome, absolute benefit, time to benefit, adverse effects, treatment burden and consequences of discontinuation. Function, disease events and the person's

goals should guide judgments about value. These considerations connect prescribing and trial design with the health-promotion objective and apply to each proposed gerotherapeutic use.[5,164]

Investigational candidates and combinations

Senolytics

Senescent cells influence inflammation and tissue function, with biological effects that vary by cell type and context.[182,183] Animal studies support investigation.[76] An uncontrolled pilot involved 11 people with diabetic kidney disease, with adipose immunohistochemistry available in nine. Dasatinib plus quercetin reduced selected adipose-tissue senescence-associated measures, but the subsequent reanalysis did not confirm several individual or skin-marker changes.[121] These exploratory findings do not establish clinical benefit or long-term safety. Controlled studies need appropriate markers, patient-relevant outcomes and careful monitoring.

NAD+ precursors

Nicotinamide riboside and nicotinamide mononucleotide can increase NAD+-related metabolites in human studies, while clinical effects depend on compound, dose, population and outcome. Evidence of general healthspan benefit remains insufficient.[122] The review found no eligible intravenous or intramuscular NAD+ outcomes trials for anti-aging or wellness use.[122] Separately, analysis of oral NMN and urolithin A products assessed discrepancies between measured and labeled content; it does not establish intravenous efficacy, safety or formulation quality.[123] An FDA safety alert describes concerns about food-grade ingredients used in sterile NAD+ compounds and reported adverse reactions compatible with endotoxin exposure.[124] Such reports do not quantify the incidence of harm. Intravenous administration requires medical oversight and route-specific evidence.

Consumer supplements and evidence from human trials

In VITAL, vitamin D and marine omega-3 supplementation did not reduce the respective primary endpoints of invasive cancer or major cardiovascular events in the overall trial population.[125,126] COSMOS-Web reported a modest memory benefit of multivitamin supplementation in older adults.[127] A post hoc exploratory DO-HEALTH analysis found small changes in selected DNA-methylation clocks with omega-3, including some additive effects with vitamin D and exercise.[184] These are distinct outcomes; biomarker changes require validation against clinical benefit.[6]

Nutritional and pathway-targeted candidates

In a 66-participant randomized urolithin A trial, the primary six-minute walk and muscle adenosine triphosphate (ATP) production outcomes were not significantly improved, although secondary muscle-endurance outcomes favored treatment.[128] Fucoidan is being evaluated in the registered Project SIRT6 (sirtuin 6) Activator study in pre-frail men aged 50–80 years; registration establishes the study's existence, not efficacy.[185] Interleukin-11 blockade extended lifespan in mice,[186] while interleukin-11

receptor antibodies have entered early human studies for specific conditions.[187] Their status should be assigned to the proposed use: human applications remain investigational and animal-only healthy-longevity applications remain preclinical.

Preclinical research and targeted early human translation

Partial cellular reprogramming aims to restore selected cellular functions while retaining cell identity. Studies in mice reported improvements in aging-related features[130] and restoration of visual function.[131] The registered ER-100 phase 1 study in adults with optic neuropathies is an investigational human application; its primary purpose is safety and tolerability.[129] Its sponsor reported the first participant dosed in June 2026, which is a development milestone rather than evidence of efficacy.[188] Broader systemic applications remain preclinical. Each requires separate control of expression and long-term monitoring for abnormal growth, loss of cell identity and other delayed harms.[5]

Substantiation of commercial claims

The US Food and Drug Administration (FDA) has warned about young-donor plasma marketed for rejuvenation because benefit is unproven and transfusion carries risks.[132] Its July 2026 Pharmacy Compounding Advisory Committee discussion of peptides concerned possible inclusion on the US 503A bulk-substances list; this does not establish approval or healthy-longevity efficacy.[133] Claims require evidence for the product, route, dose, population and outcome. National authorities should assess medical products and procedures under the applicable requirements and co-ordinate with consumer-protection authorities on misleading advertising.[20–22]

A3. TRIAL DEVELOPMENT AND SHARED RESEARCH METHODS

The following development sequence should be adapted to the proposed use, population and claim.[5,6]

- **Measurement:** Validate a target-engagement marker and define its context of use.
- **Early trials:** Establish pharmacology, dose, safety and proof of mechanism.
- **Efficacy trials:** Test relevant functional, disease or multimorbidity outcomes in defined populations.
- **External validation:** Reproduce effects across sex, ethnicity, geography, comorbidity and socioeconomic groups.
- **Implementation research:** Determine feasibility, adherence, workforce needs and integration with existing care.
- **Value assessment:** Evaluate harms, costs, opportunity costs and distributional effects.
- **Long-term surveillance:** Monitor delayed adverse effects, effectiveness and off-label diffusion.

Shared protocols, core outcomes, biobanks and interoperable registries could reduce duplication in geroscience research. Kroemer and colleagues describe

the transition towards precision geromedicine,[5] while Abdellatif, Kim and Kroemer propose hierarchical endpoints and win statistics to prioritize clinically important outcomes.[164] Existing programs, including ASPREE,[134] STAREE[89] and PROSPR[60] illustrate different approaches to outcome selection. Their methods should be compared according to population, intervention and follow-up.[5,164]

Regulatory development should specify the population, intended benefit, endpoints, duration and acceptable safety profile.[77] Trials in younger and middle-aged adults need validated measures suited to their baseline capacity and lower short-term event rates.[77] The International Classification of Diseases (ICD) and the International Classification of Functioning, Disability and Health (ICF) provide complementary starting points for recording disease and function.[160] This report proposes work with classification authorities on interoperable organ-function fields and any justified coding extensions.

Individual trajectories and co-ordinated gerointerventions

Human aging follows multiple organ trajectories.[104,170] Ferrucci and colleagues propose a framework integrating molecular, physiological and digital gerodiagnostics with longitudinal modeling and targeted interventions. Measures of recovery after a defined stressor may reveal vulnerability that resting measurements miss.[189] Validation should establish reproducibility, safety, incremental value and relevance to clinical outcomes. The framework's predictions about divergence and convergence of trajectories are testable hypotheses, not universal rules for every person. Repeated measures can distinguish a low baseline level from rapid change and support better-designed intervention studies.

Multimodal interventions should be tested against this heterogeneity. Combinations of physical activity, nutrition, cognitive training and vascular-risk management improved cognition relative to health advice in the FINGER trial,[116] and a structured multidomain program produced greater cognitive improvement than a self-guided version of the same program in US POINTER,[117] both in selected older populations. Their findings support further evaluation of co-ordinated approaches, with separate evidence required for younger adults and for combinations involving medicines.[116,117] Trial design should prespecify component outcomes, the rationale for any composite and interaction analyses.[164] Hierarchical endpoints may help prioritize outcomes according to clinical importance.[164]

Sustained longitudinal phenotyping can help identify trajectories before clinical decline.[142,165] The Alzheimer's Disease Neuroimaging Initiative provides an example of repeated imaging, biological sampling and clinical assessment linked through shared research infrastructure.[165] UK Biobank combines extensive baseline characterization with follow-up and repeat assessments.[142] Healthy longevity research should build on these models, specifying measurement intervals and representation across adult ages and populations.[142,165]

Shared trial infrastructure

PROSPR and XPRIZE Healthspan provide foundations for shared trials.[57,60] This report proposes common eligibility, measurement and safety protocols, independent replication, long-term follow-up, and publication of neutral and negative findings. Trials should record medicines, consumer products and wellness programs separately to assess their effects and interactions.[5,164]

ABBREVIATIONS

AA-HA!	Global Accelerated Action for the Health of Adolescents
AAV	adeno-associated virus
ACC	American College of Cardiology
ADA	American Diabetes Association
ADL	activities of daily living
AHA	American Heart Association
ARPA-H	Advanced Research Projects Agency for Health
ASPREE	Aspirin in Reducing Events in the Elderly
ATP	adenosine triphosphate
CAPABLE	Community Aging in Place – Advancing Better Living for Elders
CI	confidence interval
CKD	chronic kidney disease
COSMOS-Web	Cocoa Supplement and Multivitamin Outcomes Study, web based
DELIVER	Dapagliflozin Evaluation to Improve the Lives of Patients with Preserved Ejection Fraction Heart Failure
DHP	Department of Healthcare Professions
DNA	deoxyribonucleic acid
DXA	dual-energy X-ray absorptiometry
ECG	electrocardiogram
FDA	US Food and Drug Administration
FINGER	Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability
FLOW	Evaluate Renal Function with Semaglutide Once Weekly
FRAX	fracture risk assessment tool
FSHD	facioscapulohumeral muscular dystrophy
GCC	Gulf Cooperation Council
GDP	gross domestic product
GLP-1	glucagon-like peptide-1
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HbA1c	glycated hemoglobin
HMC	Hamad Medical Corporation
HPV	human papillomavirus

HR	hazard ratio
ICD	International Classification of Diseases
ICF	International Classification of Functioning, Disability and Health
ICH	International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use
ICOPE	Integrated Care for Older People
IMF	International Monetary Fund
KDIGO	Kidney Disease : Improving Global Outcomes
LIFE	Lifestyle Interventions and Independence for Elders
MoCI	Ministry of Commerce and Industry
MoPH	Ministry of Public Health
MSDF	Ministry of Social Development and Family
mTOR	mechanistic target of rapamycin
NAD	nicotinamide adenine dinucleotide
NICE	National Institute for Health and Care Excellence
NIH	National Institutes of Health
NMN	nicotinamide mononucleotide
PHCC	Primary Health Care Corporation
PREDIMED	PREvenciOn con DIeta MEDiterranea
PREVENTABLE	Pragmatic Evaluation of Events and Benefits of Lipid-Lowering in Older Adults
PROSPR	Proactive Solutions for Prolonging Resilience
QPHI	Qatar Precision Health Institute
SELECT	Semaglutide Effects on Cardiovascular Outcomes in People with Overweight or Obesity
SGLT2	sodium–glucose cotransporter 2
SIRT6	sirtuin 6
SPRINT	Systolic Blood Pressure Intervention Trial
STAREE	Statin Therapy for Reducing Events in the Elderly
UNICEF	United Nations Children's Fund
US POINTER	U.S. Study to Protect Brain Health through Lifestyle Intervention to Reduce Risk
USPSTF	US Preventive Services Task Force
WHO	World Health Organization
WHODAS	World Health Organization Disability Assessment Schedule
WISH	World Innovation Summit for Health

GLOSSARY OF TERMS

Biomarker of aging: A measurable biological characteristic intended to describe an aging-related process or predict an aging-related outcome; its interpretation depends on the validated context of use.[6]

Clinical utility: Evidence that using an assessment improves a relevant decision or patient outcome compared with an appropriate alternative.[6]

Disability-free survival: The time a person lives without mental or physical impairment caused by aging.

Exposome: The environmental and behavioral exposures considered across life.[5]

Equity: Fair opportunity to access services and achieve health, with practical support proportionate to barriers and needs.[9,11]

Functional ability: What a person is able to do that they value, arising from their intrinsic capacity, their environment and the interaction between them.[2]

Gerodiagnostics: Approaches to quantify systemic or organ-specific biological aging using clinical, biological and digital measures, including biomarker panels, omics and environmental exposure information.[5,29] Measurement validity does not itself establish clinical utility.[6]

Gerointerventions: The umbrella term used in this report for actions intended to improve health and function along aging trajectories, encompassing population, behavioral and clinical approaches. Certainty and the implementation decision depend on the particular use.[5]

Geromedicine: The medical application of geroscience to optimize health and prevent disease by addressing underlying aging processes across adult life, in people with or without diagnosed disease.[5,28,29]

Geroscience: Research into biological aging and its contribution to disease and declining function, including whether modifying aging processes can improve health.[27]

Gerotherapeutics: Medical or non-medical interventions intended to preserve systemic or organ-specific fitness and prevent or reduce aging-related functional decline and disease. This follows the Geromedicine definition and is not limited to medicines.[29] Effectiveness and safety are assessed for each intended use.

Healthspan: The period of life spent in a specified state of health. Definitions differ across studies, so the health criteria and method of measurement should be stated.[26]

Health promotion: Enabling people and communities to improve health through supportive policy, environments, skills and services.[19]

Healthy life expectancy: A population estimate of expected years in a defined health state. World Health Organization healthy life expectancy expresses expected years in equivalent full health, accounting for the prevalence and severity of health loss.[12]

Healthy longevity: Longer life with sustained health, function, wellbeing and opportunities for participation.[2,3]

Healthy longevity medicine: The clinical application of geroscience to optimize health and healthspan across adult life, in people with or without diagnosed disease.[5,25]

Intrinsic capacity: The physical and mental capacities available to a person, considered together; functional ability also depends on the environment and support available.[2,24]

Longevity dividend: The potential social and economic value of longer, healthier lives, including participation, unpaid contributions and the value of health itself.[3,15]

Precision geromedicine: Individualized geromedicine that integrates genetic and multi-omic information, clinical and digital biomarkers, psychosocial characteristics and environmental exposures to inform gerodiagnostics and gerotherapeutics. Clinical application depends on validation of the proposed assessment and intervention.[5]

Surrogate endpoint: A measure used in place of a clinical outcome, requiring evidence that treatment effects on it predict effects on that outcome.[6]

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