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The Behavioral and Economic Landscape of Cognitive Health: An Integrated Framework for Prevention and Policy

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Abstract: Cognitive health is a crucial dimension of human capital, shaping productivity, labor market participation, and long-term societal welfare. As populations age, cognitive decline and dementia create growing public-health and macroeconomic pressures that existing, largely reactive care models struggle to address. This paper develops an interdisciplinary framework integrating behavioral and health economics to analyze how individual behavior, diagnostic systems, and institutional incentives jointly determine cognitive health outcomes. Drawing on empirical literature and recent trial evidence, including the AGELESS multidomain intervention for cognitive frailty and lifetime economic modeling of the FINGER prevention program, the study examines behavioral determinants of underinvestment in cognitive health, the economic consequences of delayed diagnosis, and the cost-effectiveness of multidomain prevention. Particular attention is paid to modifiable lifestyle and cardiovascular risks, behavioral biases, and the role of digital tools in supporting prevention. The findings indicate that structured multidomain interventions can be cost-effective across settings and that effective cognitive health policy requires coordinated strategies for prevention, early detection, and incentive alignment.

Keywords: cognitive health; behavioral economics; dementia prevention; diagnostic safety; health capital; digital health;

JEL Classification: I12; D91; H51

1. Introduction: The Economic Case for Cognitive Health Investment

Cognitive health constitutes a foundational component of human capital, influencing productivity, labor force participation, decision-making quality, and overall societal welfare. As demographic transitions shift advanced economies toward aging population structures, cognitive decline and dementia are increasingly recognized as major global public health challenges with substantial economic and societal costs (WHO, 2021). Traditional approaches to cognitive disorders have been predominantly biomedical, emphasizing neuropathology, pharmacological interventions, and clinical management. While indispensable, this perspective alone is insufficient to explain persistent underinvestment in prevention, delayed diagnosis, and systemic inefficiencies in care delivery. This perspective is grounded in the human capital tradition (Becker, 1983) and its extension to health capital (Grossman, 1972),

which conceptualize health as a stock that can be accumulated, maintained, and depreciated over time.

Three structural realities motivate a broader analytical lens:

First, a substantial share of dementia risk is attributable to modifiable behavioral factors, including physical inactivity, poor diet, sleep disturbance, social isolation, and unmanaged cardiovascular risk. Recent trial evidence confirms the modifiability of cognitive trajectories through lifestyle intervention.

Second, health systems systematically underperform in early identification of mild cognitive impairment (MCI), resulting in delayed intervention and escalating long-term costs. Evidence from the OECD working paper *The Economics of Diagnostic Safety* demonstrates that diagnostic errors across healthcare systems represent a significant economic burden, accounting for a measurable share of total healthcare expenditure and GDP in advanced economies (Slawomirski et al., 2025). These inefficiencies are particularly consequential in progressive conditions such as cognitive decline, where timing critically determines cost trajectories.

Third, emerging evidence from large-scale trials demonstrates the economic viability of prevention. The Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER) program, evaluated over a lifetime horizon, shows potential cost savings of 16,928 SEK (approximately 1,600 USD) per person along with 0.043 quality-adjusted life year (QALY) gains, supporting extended dominance for multidomain prevention programs (Ngandu et al., 2023). The 2025 AGELESS trial in Malaysia further confirms that multidomain interventions can be cost-effective in low-middle income countries (LMICs), demonstrating improvements in cognitive and physical function among older adults with cognitive frailty at costs feasible for resource-constrained settings (Ponvel et al., 2025).

These findings challenge the prevailing reactive model of dementia care and invite reconsideration of prevention as an economically rational investment rather than a discretionary expense.

This paper advances the central argument that cognitive health must be understood as the product of interacting behavioral choices, economic incentives, and diagnostic system performance. Behavioral biases influence individual health investments; institutional incentives shape provider behavior; and structural inefficiencies distort resource allocation. These mechanisms jointly determine population-level cognitive outcomes and fiscal sustainability.

The objectives of this paper are threefold:

1. To analyze the behavioral and economic mechanisms that jointly determine cognitive health outcomes, with emphasis on modifiable risk factors, prevention gaps, and diagnostic inefficiencies.
2. To evaluate the cost-effectiveness of multidomain prevention programs (FINGER, AGELESS) and digital health tools, and to assess their implications for health system design and public policy.

2. Methodology

This study adopts a narrative, theory-driven review design to develop an integrated behavioral-economic framework for cognitive health. We combined targeted literature searches with purposive selection of landmark trials, economic evaluations, and policy reports rather than conducting a formal systematic review.

Literature searches were performed in PubMed, Scopus, and Google Scholar for articles published primarily in English from approximately 2000 onwards, using combinations of keywords such as "*cognitive health*", "*dementia prevention*", "*multidomain intervention*", "*FINGER trial*", "*cognitive frailty*", "*AGELESS trial*", "*behavioral economics*", "*diagnostic safety*", "*cost-effectiveness*", and "*digital health*". In addition, we screened reference lists of key articles and consulted grey literature from international organizations, including OECD and the World-Wide FINGERS Network, to capture recent economic and policy analyses.

Evidence selection was guided by conceptual relevance rather than exhaustive coverage. We prioritized: epidemiological studies quantifying modifiable risk factors for dementia; multidomain randomized controlled trials targeting lifestyle and vascular risk (e.g. FINGER, AGELESS); economic evaluations and long-term modeling studies of prevention programs; and (iv) reports on diagnostic safety and digital health–supported interventions. Data from included sources were synthesized narratively and structured around a priori themes derived from health-capital theory and behavioral economics: modifiable risk and life-course accumulation, behavioral barriers to prevention, diagnostic efficiency, multidomain interventions, digital tools as behavioral supports, and socio-economic gradients. Quantitative results such as QALYs, costs, and adherence rates were summarized in tables to facilitate interpretation by policymakers and health-economics audiences.

Because the aim was to build an integrative framework and policy overview, we did not perform formal risk-of-bias assessment or meta-analysis; limitations of this narrative approach are considered in the discussion.

2.1. Modifiable Risk Factors in Cognitive Decline

A growing body of epidemiological research indicates that a substantial share of dementia risk is attributable to modifiable behavioral and environmental factors. (Livingston et al., 2020)

Table 1. Modifiable risk factors in cognitive decline

Aspect	Description
Core idea	Dementia risk is substantially influenced by modifiable behavioral and environmental factors, not just chronological aging.
Key modifiable risk factors	Physical inactivity; hypertension and cardiovascular disease; diabetes and metabolic syndrome; obesity; social isolation; smoking; insufficient cognitive stimulation.
Biological pathways	Vascular damage; neuroinflammation; metabolic dysregulation; reduced neuroplasticity.
Life course accumulation	Early life education, midlife cardiovascular health, and later life behaviors jointly shape long run cognitive trajectories.
Economic/"capital" perspective	Cognitive capacity behaves like a stock of capital subject to depreciation and investment, consistent with the earlier framework.

Policy Implication

From a policy perspective, the presence of modifiable risk factors fundamentally changes the economic interpretation of cognitive decline. If cognitive impairment were purely genetically determined or biologically unavoidable, prevention policy would have limited scope. Instead, the existence of behavioral determinants implies that substantial portions of the future disease burden may be preventable through targeted behavioral interventions and systemic incentives.

2.2. Evidence from Multidomain Intervention Trials

The theoretical argument for multidomain intervention targeting multiple risk pathways simultaneously receives strong empirical support from recent large-scale trials. Earlier multidomain intervention studies, such as the MAPT trial (Vellas et al., 2014), provided initial evidence that combining cognitive, nutritional, and lifestyle components may influence cognitive trajectories, although results were more heterogeneous than in later trials.

The FINGER Trial

The Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER) was a landmark randomized controlled trial demonstrating that a multidomain lifestyle intervention (diet, exercise, cognitive training, vascular risk monitoring) can improve or maintain cognitive functioning in at-risk older adults (Ngandu et al., 2023). Subsequent economic modeling confirmed long-term cost-effectiveness, with lifetime savings and QALY gains.

The AGELESS Trial (2025)

The AGELESS trial, conducted in Malaysia, recruited 106 older adults (age ≥60 years) with cognitive frailty defined as the simultaneous presence of physical frailty (≥1 Fried criteria) and mild cognitive impairment (CDR = 0.5) (Ponvel et al., 2025). Participants were randomized to either a 24-month multidomain intervention or a control group receiving an educational module.

Intervention components included:

Table 2. AGELESS Trial – intervention components and primary outcomes

Element	Key finding
Physical Activity	Structured exercise programs and activity counseling
Cognitive Training	Memory and reasoning exercises
Nutrition counseling	Dietary guidance aligned with healthy aging principles
Psychological counseling	Support for mood and motivation
Cardiovascular care	Monitoring and management of vascular risk factors
Primary outcomes and timepoints	Cognitive performance, physical function, vascular health markers, and dietary behavior at 0/12/24 months

Primary outcomes assessed at baseline, 12 months, and 24 months included cognitive performance (modified Neuropsychological Tests Battery), physical function (gait speed, balance, strength), vascular health markers, and dietary behavior.

Key findings:

Table 3. AGELESS Trial – key outcome findings

Outcome category	Key finding
Cognitive improvements	Significant gains across multiple cognitive domains at 12 and 24 months
Physical function	Improved mobility, strength, and functional capacity
Vascular outcomes	Better blood pressure control and improved metabolic parameters
Dietary behavior	Increased adherence to healthy eating patterns
Cost-effectiveness	Cost-effective versus usual care, with favorable incremental cost-effectiveness ratios (ICERs)
Adherence	Overall adherence 52.8% at 12 months; 52.8%–90.6% across individual intervention modules

Significance for LMICs

The AGELESS trial is particularly significant because it demonstrates feasibility and cost-effectiveness in a low-middle income country setting. This addresses a critical gap in the evidence base, as most prior dementia prevention trials were conducted in high-income countries. The trial confirms that multidomain interventions can be adapted and implemented in resource-constrained settings where the prevention potential may be even greater due to higher prevalence of lifestyle-related risk factors.

The World-Wide FINGERS Network

Both the original FINGER trial and the AGELESS trial are part of the World-Wide FINGERS Network, an international consortium harmonizing data and methodologies across multiple prevention trials globally (Kivipelto et al., 2020). This network approach enables cross-national comparisons and accelerates translation of evidence into policy.

2.3. Behavioral Channels Linking Lifestyle and Cognitive Outcomes

The behavioral determinants of cognitive health operate through several interconnected pathways that influence both neurological resilience and systemic physiological functioning.

Table 4. Behavioral channels linking lifestyle factors to cognitive outcomes

Factor	Mechanism / effect on cognition	Evidence/example mentioned
Physical activity	Improves cerebral blood flow, supports hippocampal neurogenesis, and reduces vascular risk; sedentary lifestyle and metabolic syndrome accelerate decline	Structured programs effective in AGELESS trial
Nutrition	Unhealthy diets (processed foods, saturated fats, sugars) promote inflammation and vascular damage; healthy patterns slow cognitive aging	Nutritional counseling improved diet in AGELESS trial
Sleep quality	Chronic disruption impairs memory consolidation, increases amyloid accumulation, and reduces metabolic clearance, accelerating neurodegeneration	–
Social engagement & cognitive stimulation	Isolation and low intellectual activity speed decline; active engagement builds cognitive reserve, supporting resilience despite pathology	–
Synergistic effects of behaviors	Risk behaviors cluster and jointly amplify risk; single behavior interventions have smaller effects than multidomain programs	Multidomain approach validated by FINGER and AGELESS trials

2.4 Behavioral Economic Mechanisms Behind Prevention Gaps

Table 5. Behavioral economic mechanisms behind prevention gaps

Mechanism	Core idea	Effect on preventive behavior	Implications for intervention design
Present bias	Short term effort is overweighted relative to long term, uncertain benefits	People choose immediate comfort over exercise, diet change, or sleep hygiene	Use commitment devices, short term rewards, and near term milestones to make benefits feel more immediate
Bounded rationality	Limited capacity and health literacy to process complex, probabilistic information about cognitive decline	Reliance on heuristics and social norms instead of evidence based choices	Simplify choices, provide clear defaults, and use plain language guidance to lower cognitive load
Optimism bias	Belief that negative outcomes (e.g., dementia) are less likely for oneself than for others	Underestimation of personal risk reduces motivation to change behavior	Provide personalized, salient risk feedback and concrete scenarios that make individual vulnerability more visible
Habit formation	Diet, activity, and sleep patterns become entrenched routines that are hard to change	Even motivated individuals struggle to sustain new, healthier behaviors	Support stable routines, cues, and environments that make the desired behavior the easy, automatic choice
Behavioral prevention gap	People value healthy lifestyles in principle but systematically fail to implement them consistently	Persistent gap between intentions and real-world preventive action	Combine commitment devices, decision simplification, salient feedback, and habit building structures within interventions

Despite growing public awareness of healthy lifestyle recommendations, adherence to preventive behaviors remains limited across many populations. Behavioral economics provides insight into this persistent gap between knowledge and action.

The AGELESS trial's multidomain approach directly addresses these behavioral barriers through regular group sessions, individual counseling, and structured activity schedules (Ponvel et al., 2025).

2.5. Digital Health Technologies as Behavioral Support Tools

Given the behavioral barriers described above, interventions that rely exclusively on information dissemination are unlikely to achieve substantial changes in population behavior. More effective strategies often incorporate behavioral design elements that facilitate adherence and habit formation.

Digital health technologies have emerged as promising tools in this context. Smartphone applications, wearable devices, and remote monitoring systems allow continuous tracking of lifestyle behaviors relevant to cognitive health, including physical activity, sleep patterns, and cognitive engagement.

This emerging evidence base is supported by recent economic evaluations showing that digital lifestyle interventions targeting individuals with mild cognitive impairment can delay dementia onset and remain cost-effective over long-term horizons (Fereshtehnejad et al., 2025).

Table 6. Digital health tools as behavioral support mechanisms

	Description
Behavioral nudges	Timely prompts that encourage immediate actions aligned with long term cognitive health goals
Personalized feedback	Tailored messages based on an individual's progress, risk profile, and adherence
Goal setting mechanisms	Structured, specific targets that reduce ambiguity and help translate intentions into concrete actions
Social support	Digital or hybrid peer connections providing motivation, accountability, and shared experience
Economic modeling evidence	Frontiers in Public Health model shows digital lifestyle programs for MCI may delay dementia and be cost effective over long horizons
Role in health economic frameworks	Demonstrates how behavioral interventions can be parameterized (uptake, adherence, risk reduction) in cost effectiveness and budget impact models
Integration with multidomain programs	My AGELESS and similar telerehabilitation trials test remote delivery of multidomain interventions, aiming to preserve effectiveness while lowering delivery costs and improving access

2.6 Socioeconomic Gradients in Cognitive Health Behavior

Behavioral determinants of cognitive health are not distributed evenly across populations. Socioeconomic conditions strongly influence both exposure to risk factors and capacity to engage in protective behaviors.

Individuals with lower educational attainment and income levels often face structural barriers that limit preventive behavior. These barriers may include:

- Educational attainment plays a particularly important role because it contributes to cognitive reserve while also influencing health literacy and long-term decision-making capacity. Higher levels of education are associated with greater engagement in cognitively stimulating activities and stronger adoption of preventive health behaviors.
- Empirical evidence also suggests that culturally specific factors and acculturation-related characteristics may shape cognitive health trajectories and access to prevention, particularly in heterogeneous populations (Lamar et al., 2023).
- Income inequality can also amplify risk exposure through environmental factors such as housing instability, urban pollution, and chronic psychosocial stress. These factors interact with behavioral patterns, creating compounding disadvantages that accelerate cognitive decline in vulnerable populations.

Policy Implications

From an economic perspective, these gradients highlight the importance of considering distributional effects when designing cognitive health policy. Preventive interventions that rely solely on individual initiative may disproportionately benefit already advantaged populations, thereby widening health inequalities.

Effective policy must therefore incorporate structural supports such as accessible community programs, subsidized interventions, and integrated healthcare delivery to ensure that prevention benefits reach populations at highest risk.

3. Results

Cognitive health policy must move beyond isolated clinical actions toward an integrated system strategy that aligns early detection, multidomain prevention, and behavioral support with long-term economic goals. The evidence from trials such as FINGER and AGELESS, together with broader epidemiological data on modifiable risk factors, shows that timely identification.

Taken together, the evidence reviewed here supports three system-level recommendations. First, routine cognitive screening for adults aged 60 and above, embedded in primary care check-ups, can bring individuals into preventive care earlier and at lower long-term cost. Second, multidomain programs combining physical activity, nutritional guidance, cognitive training, and vascular risk management – as demonstrated by the FINGER (Ngandu et al., 2023) and AGELESS (Ponvel et al., 2025) trials – should receive structured public reimbursement, since lifetime modeling indicates net cost savings alongside QALY gains. Third, digitally delivered behavioral support tools can extend the reach of such programs at lower marginal cost, though they require formal health-technology assessment before integration into reimbursement frameworks. Equity must be embedded in all three pillars: targeted subsidies and community-based delivery are necessary to prevent prevention benefits from accruing disproportionately to already-advantaged groups (Livingston et al., 2020).

4. Discussion

This study develops an integrated behavioral-economic framework for cognitive health by synthesizing evidence from landmark prevention trials, health-capital theory, and behavioral science. The central finding is that cognitive health outcomes are systematically shaped by modifiable behavioral factors, institutional incentive structures, and the quality of diagnostic pathways – none of which operates in isolation.

The behavioral-economic perspective contributes meaningfully to existing prevention literature by extending the health capital framework (Grossman, 1972) to cognitive outcomes and making explicit the mechanisms through which individual underinvestment in cognitive health arises. Present bias, optimism bias, and bounded rationality – mechanisms extensively documented in the behavioral economics literature (Kahneman, 2011; Thaler & Sunstein, 2008) – explain why knowledge of dementia risk does not automatically translate into preventive action. This behavioral gap is precisely what the structured group sessions and commitment mechanisms in AGELESS and FINGER are designed to close (Ponvel et al., 2025; Ngandu et al., 2023).

A key contribution of the paper is linking diagnostic system performance to the economics of cognitive health. OECD analysis of diagnostic safety establishes that delayed or missed diagnoses impose measurable costs on health systems (Slawomirski et al., 2025). In a progressive condition such as cognitive decline, diagnostic delay shortens the window for cost-effective intervention. The policy implication is that improving diagnostic accuracy is not merely a clinical quality concern but an investment with quantifiable returns in avoided care costs.

Several limitations warrant acknowledgment. The narrative review design, while appropriate for building an integrative framework, does not permit formal meta-analytic estimates of effect sizes or costs. The AGELESS trial, though informative, involved a relatively small sample (n = 106) in a single LMIC setting, limiting the generalizability of its cost-effectiveness estimates. Similarly, the FINGER lifetime model relies on Swedish health-system cost parameters that may not translate directly to other contexts. Future research should apply the proposed framework to multicountry longitudinal data and test the causal mechanisms identified here using quasi-experimental designs or large-scale RCTs with embedded economic evaluations.

5. Conclusions

Cognitive health represents a critical form of human capital with profound implications for individual well-being, labor market participation, and broader economic performance. It is shaped by the interaction of modifiable risk factors, behavioral biases that lead to systematic underinvestment, and diagnostic inefficiencies that delay effective intervention. Evidence from multidomain trials such as FINGER and AGELESS shows that structured programs targeting physical activity, nutrition, cognitive training, and vascular risk can prevent or slow decline in a cost-effective way, with lifetime models indicating both QALY gains and net cost savings when scaled at the population level. These findings, together with estimates that a substantial share of dementia cases is attributable to modifiable risks, strengthen the economic case for moving from reactive treatment toward proactive, long-horizon prevention and early detection. Effective policy therefore requires coordinated system-level reform: routine screening and improved diagnostic accuracy to bring interventions earlier in the disease course, funded multidomain prevention programs, behavioral support delivered through digital and community-based tools, and equitable access for high-risk and disadvantaged groups. At the macro level, such investments generate positive externalities by preserving productivity, reducing informal caregiving burdens, and lowering long-term health and social care expenditure benefits that individuals do not fully internalize in their private decisions, and that justify active public intervention. In this light, cognitive health should be treated not just as a clinical outcome, but as part of a society's economic infrastructure, warranting sustained, evidence-based investment and rapid translation of existing trial results into policy and practice.

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