

The Actionable Decade

Cross-Domain Decoupling as an Actionable Signal for Early Intervention in Mid-to-Late Life

Kate Xing, Sun Kim, Crane Huang
MCiM '26, School of Medicine, Stanford University

Abstract

Background. Population aging is conventionally modelled as a synchronized, chronologically indexed decline, and dominant frameworks (Rowe and Kahn's Successful Aging; the WHO Intrinsic Capacity model) rely on population averages or cumulative deficit counts that obscure within-person heterogeneity. The 100-million-strong U.S. population aged 55 and over is not one category but at least four developmentally distinct strata, and subjective flourishing rises with age along a J-shaped curve even as disease burden accumulates.

Methods. Using the U.S. Health and Retirement Study (HRS; 1992–2022; ~44,320 individuals, ~251,800 person-wave observations; RAND HRS Longitudinal File v1), we operationalize aging as decoupling, defined as the within-person standard deviation across seven standardized life domains. We characterize domain trajectories, onset timing, tertile-based prospective prediction, convergent and discriminant validity, and joint multivariable models of 5- and 10-year mortality and later-life functional limitation, with subgroup stratification by sex, race/ethnicity, and education.

Results. Aggregate decoupling is flat across ages 55–74 yet conceals trajectories that fan apart, with social connection decoupling earliest. Baseline decoupling at 55–69 is near-orthogonal to chronological age ($r = 0.17$) but forecasts a substantially greater later-life functional deficit (the high-decoupling tertile carries $\approx 1.4\times$ the deficit burden by the oldest ages). In pooled models, physical and functional health dominate mortality while functional and cognitive health dominate disability; adding the seven domains improves 5-year-mortality discrimination from AUC 0.81 to 0.87.

Conclusions. Within-person decoupling, emerging first in the psychosocial domains and roughly a decade before clinical frailty, identifies the 55–74 window as the highest-leverage period for preventive intervention. We translate this signal into three intervention priorities and four design principles for non-stigmatizing, mastery-framed, AI-enabled care, and situate them against the current solution landscape and reimbursement environment.

1 · Introduction

The United States is undergoing a demographic transformation of historic proportions. In 2022, 57.8 million Americans were aged 65 or older (17.3% of the population); this figure is projected to reach 71.2 million by 2030 and to nearly double to 106.3 million by 2100 (FIFARS, 2024; U.S. Census Bureau, 2023). Adding the 42.4-million-strong cohort aged 55–64, the population aged 55 and over exceeds 100 million, nearly one-third of all Americans, while the segment aged 85 and over is the fastest-growing. Most senior technology and care infrastructure targets late-stage vulnerabilities such as chronic disease, falls, and caregiving. Yet for the large, growing, and comparatively healthy population of early-aging adults (≈ 55 –75), the central struggle is as much psychosocial and financial as clinical, encompassing the loss of structured roles, purpose, and identity that accompanies the retirement transition.

1.1 The heterogeneity of aging

Both research and policy have traditionally treated “older adults” as a unitary category, typically defined as those aged 65 and over. This conflation obscures qualitative differences between a recently retired 66-year-old and a frail 90-year-old, and it leaves the high-leverage 55–64 window largely outside the aging research enterprise. Drawing on established gerontological distinctions (Neugarten, 1974; Baltes and Smith, 2003) and extending the lower boundary to 55 to capture the pre-retirement transition (Wood and Pachana, 2025), we distinguish four developmentally distinct strata: Emerging Seniors (55–64), the inflection point of aging, still largely working and navigating sandwich-generation caregiving and retirement-identity stress; the Young-Old (65–74), in which improving mortality and the emotional gains of socioemotional selectivity coexist with rising suicide and a 58% increase in drug-related deaths; the Old-Old (75–84), in which multimorbidity becomes near-universal and falls and dementia accelerate; and the Oldest-Old (85+), the fastest-growing stratum, bearing the highest dementia burden yet reporting the highest subjective well-being of any group (Table 1).

This last observation is not incidental. Read through a composite flourishing index (the Global Flourishing Study; VanderWeele et al., 2025; over 200,000 participants across 22 countries), subjective flourishing rises monotonically across the four strata (7.14, 7.25, 7.33, 7.36 on a 0–10 scale) even as objective disease burden increases, and the gains are real and multidimensional. The textbook U-shaped well-being curve is, in these data, J-shaped: flat through ages 18–49, then rising from 50 onward without reversal. The central question is therefore not how to prevent an inevitable decline, but how to detect, early and unobtrusively, who is diverging from their own healthy trajectory, and to act while that trajectory remains malleable.

Table 1. Sociodemographic and epidemiological profile of the four aging strata

Dimension	55–64	65–74	75–84	85+
Demographics				
Population, 2022	42.4M	33.0M	16.8M	6.5M
Share of U.S. population	12.7%	9.9%	5.0%	1.9%
Projected growth to 2060	stable	+18%	+61%	+169%
Physical health				
Multimorbidity (≥2 conditions)	52.7%	~64%	72–78%	80.4%
Hypertension	~52%	71.6%	>72%	~67%
Needs ADL/IADL assistance	~3%	~9%	27%	~50%
Alzheimer's disease	<1%	5.0%	13.2%	33.4%
Mental health and well-being				
Depression (range by setting)	10–15%	8.7–19.2%	19–61%	up to 60.7%
Suicide rate (per 100,000)	29.6–29.8	29.2–29.5	19.4	22.7
Flourishing index (GFS, 0–10)	7.14	7.25	7.33	7.36

Table 1. Group-label rows are shown in bold. Multimorbidity and physical indicators from FIFARS (2024), Dooley et al. (2025), NCHS data briefs, and the Alzheimer's Association (2025); depression and suicide ranges from Jalali et al. (2024), AHR (2025), and CDC (2024); flourishing from VanderWeele et al. (2025). Depression ranges reflect variation by instrument and by community versus institutional setting. The 75–84 multimorbidity estimate is triangulated; no post-2020 U.S. study reports this prevalence for the subgroup in isolation.

1.2 Beyond chronological and deficit-based paradigms

Strategic health frameworks have historically been blind to the 55–74 window, treating it as a stable phase between occupational productivity and geriatric frailty. The dominant paradigms share a structural limitation: Rowe and Kahn's Successful Aging model classifies individuals against population-level criteria for disease, function, and engagement, and cumulative deficit-count indices (frailty indexes) sum impairments into a single scalar. Both are between-person constructs that are largely orthogonal to the signal we argue matters most, namely how an individual's internal domains diverge from one another over time. The WHO Intrinsic Capacity framework moves usefully toward a within-person, function-centered view by tracking five capacities (locomotor, vitality, sensory, cognitive, psychological), but it remains oriented to absolute capacity levels rather than to the dispersion among domains.

Our contribution is to operationalize that dispersion. A 65-year-old with preserved cardiovascular health but a contracting social network and emerging depressive symptoms is, on a deficit count or an intrinsic-capacity profile, only mildly impaired; on a measure of cross-domain divergence, that person is conspicuous, and requires a fundamentally different and earlier intervention than population averages would suggest. We define the 55–74 window as the Actionable Decade: the period when cross-domain trajectories first visibly decouple, when psychosocial risk accumulates silently, and when evidence-based, technology-enabled intervention can still redirect long-term trajectories. By the time an individual reaches Medicare eligibility (65) or clinical frailty (75+), the window for reversible, high-impact intervention has often closed.

2 · Methods

2.1 Study population and data

We analyzed the U.S. Health and Retirement Study (HRS), a nationally representative biennial panel of U.S. adults aged 50 and over conducted by the University of Michigan with sponsorship from the National Institute on Aging (NIA U01AG009740). We used the harmonized RAND HRS Longitudinal File v1, covering waves 1–16 (1992–2022), comprising approximately 44,320 unique individuals and approximately 251,800 person-wave observations. Because the study enrolls overlapping birth cohorts and follows participants across waves, individuals contribute varying numbers of person-wave observations; the analytic implications of this structure are addressed in Section 2.4 and the Limitations.

2.2 Domain construction and standardization

We mapped RAND HRS variables onto seven standardized sub-dimensions spanning the framework's three pillars: physical health, functional ability, and cognition (physical pillar); mental health and social connection (psychological pillar); and financial security and housing/environment (financial and environmental pillar). Each sub-dimension was recoded so that higher values indicate better function, then z-scored against the full HRS 50+ pool (mean 0, SD 1). The exact variable-to-domain mapping and transformations are detailed in Appendix A. A minimum of five of the seven domains was required for an observation to be scored.

2.3 The Decoupling Score

For an individual i at wave t with K available domains ($K \geq 5$), the Decoupling Score D_{it} is the within-person standard deviation across the standardized domain z-scores:

$$D_{it} = \sqrt{\left(1 / (K - 1)\right) \cdot \sum_{k=1}^K (z_{itk} - \bar{z}_{it})^2}$$

where z_{itk} is the z-score of domain k for person i at wave t , and $\bar{z}_{it}$ is the within-person mean across the K available domains. We refer to $\bar{z}_{it}$ as the composite well-being score. A higher D_{it} indicates greater internal dispersion (more decoupling); a higher $\bar{z}_{it}$ indicates better overall standing. The two are analytically distinct: a person can be uniformly average (low dispersion) or uniformly excellent, and decoupling captures the spread, not the level.

2.4 Statistical analysis

Descriptive trajectory and onset estimates pool all available person-waves within seven five-year age bands. For each domain, onset is defined as the earliest age band at which the band mean falls a clear effect size (Cohen's $d \leq -0.2$) below the 55–59 baseline. Predictive analyses use each individual's single baseline observation, defined as the first wave observed in ages 55–69, so that each person contributes one row and within-person correlation does not arise in those models. We assigned individuals to low, middle, and high decoupling tertiles by their baseline score and followed the same individuals forward across subsequent age bands. Driver models are joint multivariable regressions of prospective outcomes (logistic for 5- and 10-year mortality; ordinary least squares for ADL+IADL burden at 75+) on all seven baseline domain z-scores plus age and sex, fitted in the pooled sample and, separately, stratified within subgroups defined by sex, race/ethnicity, and education. Standardized coefficients (β) are reported per +1 SD of domain function; discrimination is

summarized by the area under the ROC curve (AUC). Because descriptive estimates pool repeated observations within persons, their confidence intervals should be read as descriptive, and a person-level random-intercept formulation is a natural extension (Limitations). Convergent and discriminant validity were assessed against concurrent self-rated health, life satisfaction, and chronological age. As a sensitivity analysis, extending the baseline window from 55–69 to 55–74 preserved the domain ranking.

3 · Results

3.1 Aggregate stability masks domain divergence

Mid-life health stability is a deceptive aggregate. Mean within-person decoupling is essentially flat between ages 55 and 74 ($SD \approx 0.66$ – 0.68) and accelerates only after 75 (0.96 by $85+$; Table 2), yet individual domain trajectories actively fan apart across the same window (Figure 1). The divergence is sequenced rather than simultaneous: measured against the 55–59 baseline, social connection and physical health are the earliest domains to cross a clear effect size (by ages 60–64), functional ability and cognition follow after 70, and financial security rises rather than falls until late life. The earliest and most silent signal is psychosocial.

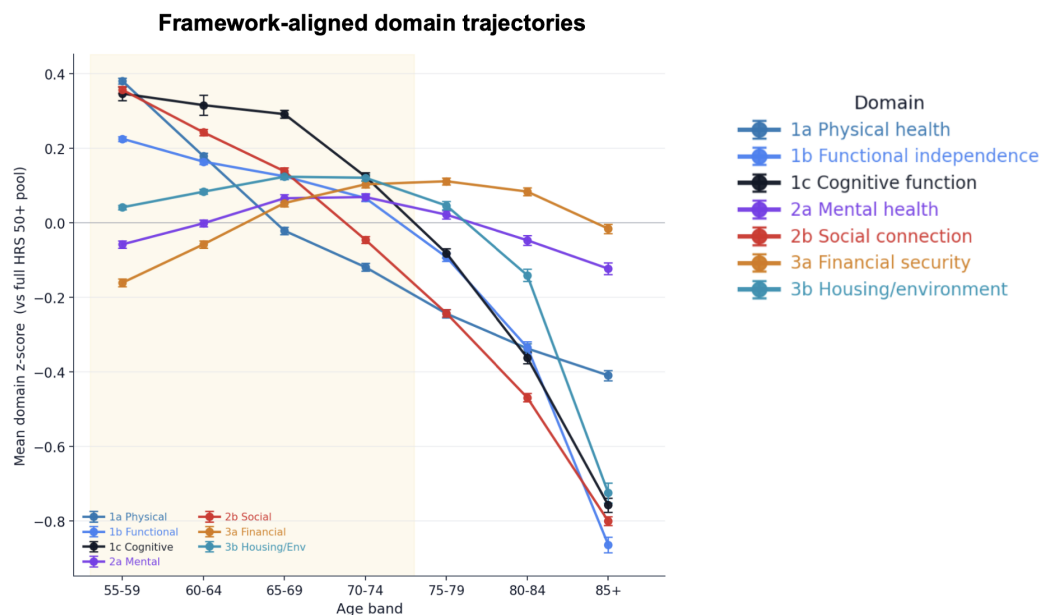


Figure 1. Framework-aligned domain trajectories on the z-score scale (HRS 50+). Domains stay roughly together through the shaded 55–74 actionable window, then fan apart in late life; physical health crosses below the pool average first while financial security peaks late. Measured against the 55–59 baseline, social connection and physical health are the earliest to cross a clear effect size ($|d| \geq 0.2$ by 60–65), cognition and functional ability follow after 70, and financial security rises rather than falls until late life. n per age band 8,441–52,379. Source: HRS 1992–2022, RAND HRS Longitudinal File v1.

3.2 Baseline decoupling predicts later-life function

Baseline decoupling at ages 55–69 is a potent prospective predictor of later disability. Assigning individuals to low versus high decoupling tertiles at baseline and following the same people forward, the high-decoupling cohort separates progressively on composite well-being, cognition, and ADL/IADL deficits, accumulating approximately 1.4× the functional-deficit burden by 85+ (≈5.0 versus 3.6 ADL/IADL+mobility deficits; Cohen’s *d* up to 0.76 across the window; Figure 2). Because mortality selectively removes the most decoupled individuals, these gaps understate the true effect.

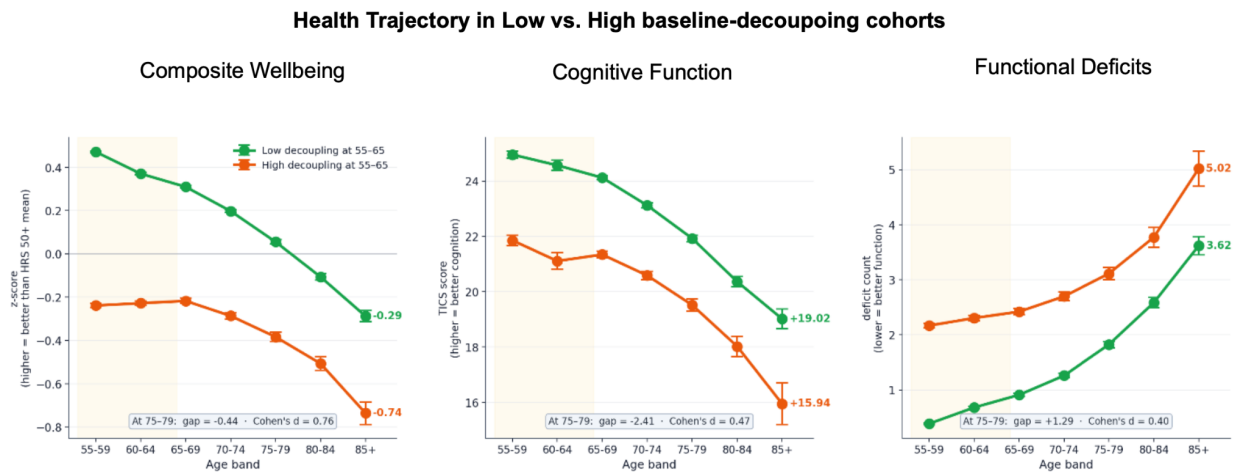


Figure 2. Same people, three outcomes. Individuals split into low versus high decoupling tertiles at baseline (55–65) and followed forward: (a) composite well-being, (b) cognition (TICS), and (c) ADL+IADL+mobility deficits. The high-decoupling cohort is worse on every outcome and diverges with age (Cohen’s *d* 0.36–0.76 at 75–79). Survivor bias attenuates the late-life gap. Source: HRS 1992–2022, RAND HRS v1.

3.3 Convergent and discriminant validity

The decoupling score shows the expected validity pattern (Table 2). Mean decoupling rises monotonically across worse self-rated health ($r = 0.351$) and falls with higher life satisfaction ($r = -0.303$), while correlating only weakly with chronological age ($r = 0.167$) (Figure 3). The near-orthogonality to age is the crux of the intervention logic: two individuals of the same age can present identical birthdays yet markedly different internal domain profiles and prospective trajectories. Age is not the right unit of measurement; the mismatch between domains is.

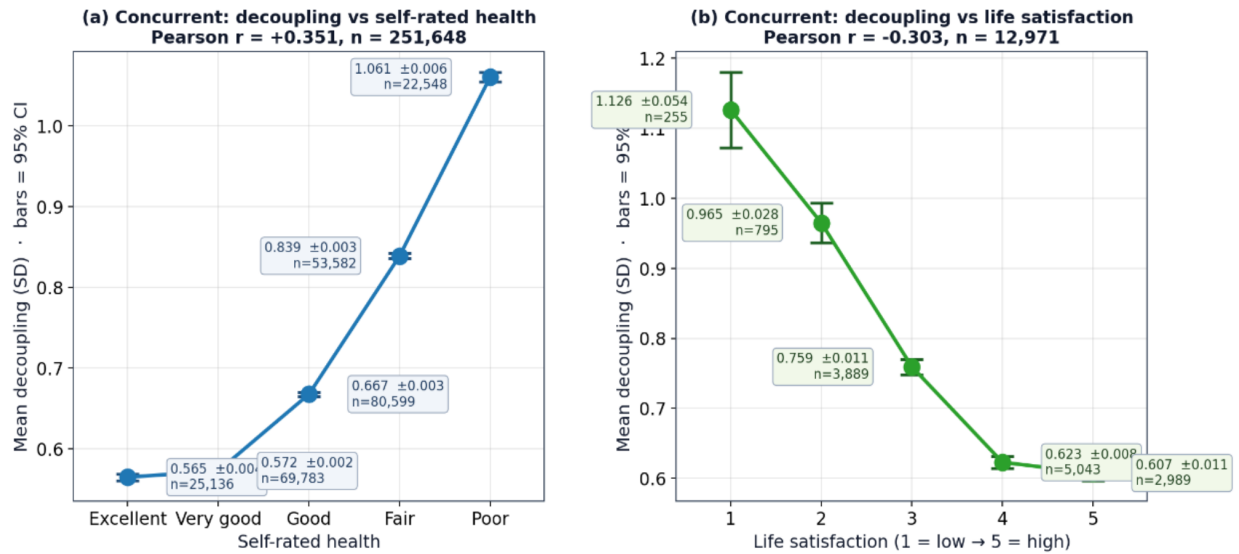


Figure 3. External validation of the decoupling score against concurrent health perception (HRS 1992–2022). Mean decoupling rises monotonically across worse self-rated health (panel a; $r = +0.351$, $n = 251,648$) and falls with higher life satisfaction (panel b; $r = -0.303$, $n = 12,971$). Bars are 95% confidence intervals, tight because n is large. Panel (a) uses the full HRS 50+ pool; panel (b) is restricted to person-waves carrying the Leave-Behind life-satisfaction module. Source: HRS 1992–2022, RAND HRS Longitudinal File v1.

Table 2. Decoupling gradient by age and validity coefficients

Metric	Value	Detail
Mean decoupling 55–59	0.675	95% CI 0.672–0.679
Mean decoupling 65–69	0.656	95% CI 0.652–0.659 (flat through the window)
Mean decoupling 75–79	0.713	95% CI 0.709–0.717 (inflection)
Mean decoupling 85+	0.961	95% CI 0.954–0.968 (acceleration)
r with self-rated health	0.351	Convergent
r with life satisfaction	-0.303	Convergent
r with chronological age	0.167	Discriminant; near-orthogonal to age

Table 2. The flat 55–74 mean masks accumulating heterogeneity; the near-zero age correlation distinguishes decoupling from chronological aging.

3.4 Domain-specific drivers of mortality and disability

Joint multivariable models identify which baseline domains carry the prospective signal (Figure 4). The reported coefficients are from the pooled model fitted on all participants with adjustment for age and sex, and are distinct from the within-stratum coefficients in Figure 5. In the pooled model, physical ($\beta = -0.43$) and functional ($\beta = -0.36$) baseline function are the strongest independent predictors of 5-year mortality, with cognition and social connection also independently protective; functional ability dominates later-life disability ($\beta = -0.93$), followed by cognition ($\beta = -0.34$) and mental health ($\beta = -0.16$, $p < 0.001$). Adding the seven domains improves 5-year-mortality

discrimination from AUC 0.81 (age and sex only) to 0.87. The near-identical sub-stratified values visible in Figure 5 (for example, $\beta = -0.44$ for physical and -0.43 for functional among men) are fitted within each stratum and should not be read as the pooled estimates.

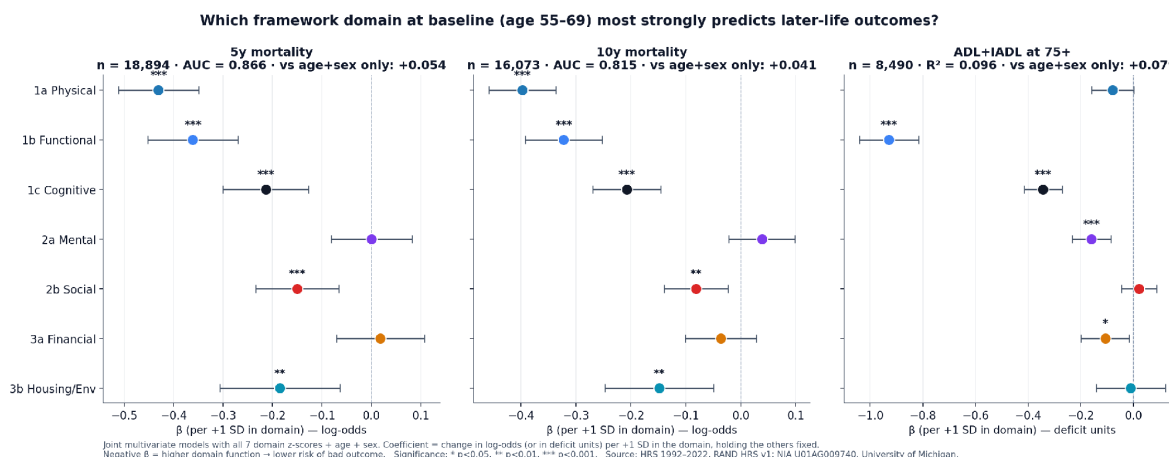


Figure 4. Pooled-model results: which baseline domain (age 55–69) most strongly predicts later-life outcomes, from joint multivariable models on all participants. Coefficients are change in log-odds (mortality) or deficit units (ADL+IADL) per +1 SD of domain function, holding the others fixed. Physical, functional, cognitive, and social domains carry the joint signal; mental health predicts disability though not mortality. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

3.5 Subgroup heterogeneity

The domain hierarchy is broadly stable but not uniform across subgroups (Figure 5). Functional ability dominates later-life disability in every stratum, but the secondary mortality drivers shift: social connection is the strongest single mortality protector for Hispanic baselines ($\beta = -0.36$ versus -0.15 for non-Hispanic White), and cognition rivals physical health for low-education baselines, who also begin 0.58 SD lower on financial security and 1.02 SD lower on cognition at ages 65–69. These two gradients carry direct translational implications, developed in the Discussion: the elevated social-protective effect among Hispanic adults supports tailoring psychosocial detection to that group, while the compounded cognitive and financial disadvantage of lower-education adults makes financial navigation most consequential for them.

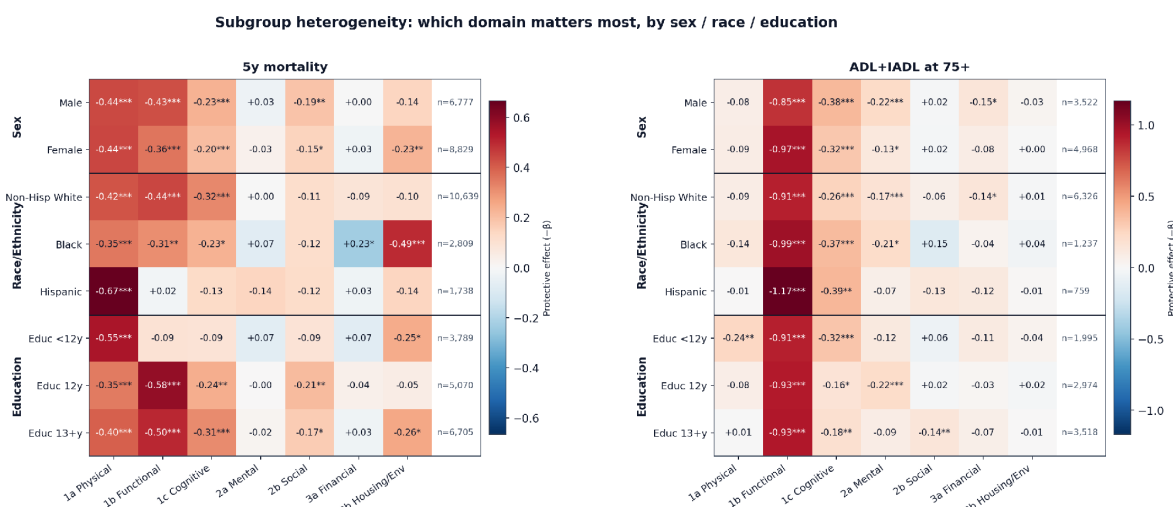


Figure 5. Subgroup heterogeneity: which baseline domain matters most for 5-year mortality (left) and ADL+IADL at 75+ (right), by sex, race/ethnicity, and education. Cells show standardized β from joint models fitted within each subgroup (age controlled); positive (red) means higher domain function predicts a better outcome. Functional ability dominates disability universally, but mortality drivers vary by subgroup. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Source: HRS 1992–2022, RAND HRS v1.

4 • Discussion

Three findings cohere into one argument. The aging population is heterogeneous in ways that aggregate statistics conceal; that heterogeneity has a measurable, prospective structure, within-person decoupling, that emerges first in the psychosocial domains and roughly a decade before clinical frailty; and the score is near-orthogonal to chronological age, so it captures biological and psychosocial divergence that a birthday cannot. The implication is a principle we term *compounding healthy aging*: investments at earlier stages generate multiplicative returns later. Purpose acquired at 55–64 is associated with lower dementia risk at 75–84; social networks maintained early buffer isolation at 85+; financial decisions optimized at 62–70 protect autonomy through the cognitive transition. The marginal value of intervention is therefore front-loaded into the Actionable Decade, which inverts the prevailing allocation of attention toward the oldest, frailest, and least-modifiable cells.

This reframing also exposes a structural blind spot. Clinical labels of “healthy” based on the absence of diagnosed disease miss exactly what decoupling captures: throughout the 55–74 window, individuals can appear synchronized on a diagnostic checklist while diverging on everything it omits. Reimbursement is calibrated to physical signals (blood pressure, HbA1c, body-mass index) and is structurally deaf to the psychosocial markers that move first, and the pre-Medicare band (55–64), the highest-leverage stratum, lacks Medicare pathways entirely. The interventions our analysis most strongly motivates are precisely those the system is least built to deliver.

4.1 From signal to solution: the intervention landscape

To assess what existing solutions address these signals, we mapped the digital and clinical intervention landscape across a domain-by-age matrix, grading each cell on market density, evidence grade, age-stratum specificity, delivery channel and workforce dependency, equity footprint, and barriers to scale. To keep the analysis at the level of mechanism rather than

commerce, we describe technologies by archetype; representative commercial examples are listed by archetype in the note to this section.

In the physical-health domain, the landscape resolves into three structurally different tiers. For the pre-Medicare band (54–64), consumer remote-monitoring devices and app-based metabolic-management and diabetes-prevention platforms are densely available but condition-siloed and unreimbursed. For the 65–74 band, remote patient monitoring and chronic-care-management platforms gain Medicare reimbursement, making this the one stratum where consumer revenue and reimbursement are simultaneously viable. For the 75+ band, motor impairment from arthritis (53.9%) and mild cognitive impairment (22–28%) make active self-management interfaces unworkable, so passive sensing is the only scalable architecture. The grade-A evidence anchors are foundational trials (intensive blood-pressure control; structured lifestyle diabetes prevention), not consumer products.

In the psychological domains, the evidence-based modalities (internet-delivered cognitive behavioral therapy with large self-guided effects; collaborative care; and life-review and reminiscence therapy, which reaches an exceptional pooled effect on late-life depression) are strong but uniformly high-workforce-dependency, set against only approximately 2,000 board-certified geriatric psychiatrists for a 55+ population exceeding 100 million. Consumer loneliness solutions, principally on-demand human companion-care networks and peer learning communities, are densest at 65–74 but structurally fragile, as the 2023–24 withdrawal of several major Medicare Advantage payers from companion-care contracts demonstrated. Life review is notable as the one modality whose grade-A, large-effect evidence extends into the dementia population and the oldest-old.

In the financial and environmental domains, the sharpest evidence-to-practice gaps appear. Consumer fraud-awareness training, the most widely deployed protective intervention, has no evidence of reducing actual fraud incidence even as losses grew 43% year-on-year to \$4.8 billion, and public benefits-counseling reaches under 3% of eligible beneficiaries. Fall prevention has grade-A evidence for the interventions (exercise programs; occupational-therapy home modification) but only grade-C evidence for the consumer products (wearable and ambient fall-detection devices), and rural elder transportation has neither a federal program nor a market-rate alternative. A single design opportunity recurs across both domains: passive, ambient, no-action-required monitoring, which is fully cognitively accessible to the oldest-old who fail to engage with active products but is blocked from reimbursement by a grade-C evidence ceiling.

Representative commercial examples by archetype (for reference only; not endorsements): consumer remote monitoring and metabolic management (Omron, Withings, Noom, Virta, Omada); remote patient monitoring and chronic-care management (Current Health, Cadence); on-demand companion-care networks (Papa, Wider Circle); peer learning communities (GetSetUp, Senior Planet); voice-interactive AI companions (ElliQ); legacy and life-review products (StoryWorth, Remento, StoryCorps); financial monitoring and benefits navigation (Carefull, EverSafe, SHIP, BenefitsCheckUp).

Three structural findings follow. First, a risk-evidence inversion: the cells with the highest clinical risk hold the weakest evidence and the sparsest products. The 85+ column contains the male-suicide peak, 59% loneliness among adults in fair or poor health, peak dementia, peak fall mortality, and peak exploitation risk, yet holds a single consumer product category with published observational evidence. Second, a workforce-dependency gradient: the middle-band cells with the strongest programme evidence are uniformly supply-constrained, placing a structural ceiling on human-delivered care where need is rising. Third, an AI-amplification opportunity: three cells (mental health at 75–84 and 85+, and social connection at 85+) combine high workforce dependency, dense demand, low technology literacy, and cognitive-accessibility needs, pointing specifically toward

voice-first modalities. In 2026 a voice-interactive AI companion (ElliQ) became the first social AI device to receive state Medicaid long-term-services-and-supports reimbursement, establishing a more durable funding precedent than the annually renegotiated Medicare Advantage supplemental-benefit contracts.

4.2 Three prioritized interventions

Mapping the decoupling timing and the driver hierarchy onto the landscape yields three priorities (Table 3, Figure 6), each aligned with the domains that move earliest or matter most.

- 1. Passive psychosocial signal detection (ages 55–65; mental health and social connection).** Social connection is the earliest psychosocial decoupler, crossing a clear effect size by 65–69 before a clinical encounter would notice, yet it remains invisible to self-report and unbilled under fee-for-service Medicare. The intervention shifts from biased self-report to passive ambient sensing, using behavioral digital biomarkers (typing dynamics, voice prosody, communication and calendar density) embedded in productivity tools so that detection precedes both symptom recognition and entrenchment.
- 2. Longitudinal health companion (ages 55+; physical and cognitive).** Because physical, functional, and cognitive health carry the largest joint predictive signal, the second priority is a product that does not yet exist: one that follows a person through the full arc of early aging, building a multi-domain profile over time, detecting when dimensions decouple, and adapting support as needs evolve. Current health technology is episodic and siloed (a fitness tracker at 55, a medication app at 70, a fall alert at 80), each seeing one moment and one domain; the decoupling score is the companion's native integrating signal.
- 3. Financial and benefits navigation (ages 60–74; financial security).** Financial security peaks at 70–74 just as cognitive defenses begin to slip, and irreversible federal decisions cluster inside this window: Social Security claiming (earliest 62, maximum delay 70) and Medicare enrollment (65). The intervention provides health-trajectory-aware claiming models, automatic screening for unclaimed benefits, and passive transaction-anomaly detection that doubles as fraud protection and a cognitive-monitoring signal, most valuable for the lower-education baselines with the largest absolute gap.

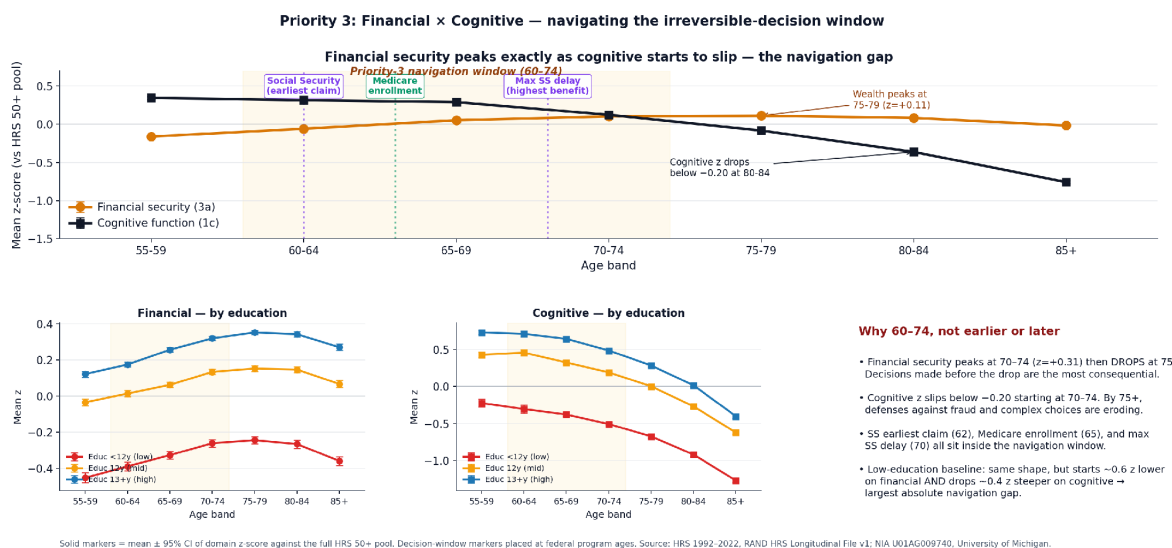


Figure 6. The navigation gap. Financial security (orange) peaks at 70–74 exactly as cognitive function (black) drops below baseline, defining the navigation window (60–74) in which Social Security, Medicare, and benefit decisions are most consequential and still cognitively feasible. Insets show the same crossover by education. Source: HRS 1992–2022, RAND HRS v1.

Table 3. The three prioritized interventions

Priority	Target ages	Primary domains	Signal type	Channel
1. Passive psychosocial signal detection	55–65	Mental health, Social connection	Passive / ambient	D2C / Employer benefits
2. Longitudinal health companion	55+	Physical, Functional, Cognitive	Continuous multi-domain	D2C / Employer / Medicare
3. Financial and benefits navigation	60–74	Financial security	Active + anomaly detection	D2C / Medicare / Counseling

Table 3. Priorities ordered by alignment with the domains that decouple earliest (Priority 1) or carry the largest joint predictive signal (Priority 2), and by the timing of irreversible financial decisions (Priority 3). D2C, direct-to-consumer.

4.3 Design principles for AI-enabled care

The 55–74 cohort has the highest preventive leverage and the lowest tolerance for being treated as patients. Four design principles follow directly from the analysis, and every product must satisfy all four: it must be non-stigmatizing, mastery-framed, and embedded in existing behavior rather than positioned as a health intervention.

- 1. Detect decoupling passively.** Shift from biased self-report to ambient signals (typing dynamics, gait, voice prosody), because the earliest-moving domains are precisely those people are least likely to self-report.
- 2. Embed in existing behavior.** Position products within tools people already use, such as productivity suites, civic platforms, and financial planners, to avoid the identity threat that suppresses adoption of explicitly senior-branded products.
- 3. Preserve mastery and agency.** Design to empower rather than infantilize; identity threat, not technology literacy, is the primary adoption barrier in this cohort.
- 4. Build cognitive screening into every interaction.** Use routine product engagement as a continuous, low-friction channel for early detection, turning ordinary use into a longitudinal cognitive signal.

4.4 Policy context

The shift to domain-aware, early-intervention care is supported by a converging set of 2024–2026 policy developments: a Medicare dementia-care navigation model scaled across 390 organizations (2024); reauthorization of federal dementia coordination through 2035 (2024); new low-threshold remote-monitoring and cognitive-behavioral codes plus advanced primary-care-management codes that reduce workforce dependency (2026 Physician Fee Schedule); a ten-year outcomes-aligned chronic-care payment model (2026); and a real-world-evidence pathway for digital-health pre-authorization (2025). The most significant remaining inequity is the pre-Medicare gap (55–64); advocacy for a preventive, domain-aware Medicare benefit beginning at 60 is the single most impactful policy target for the interventions described here.

4.5 Limitations

Several limitations bound these conclusions. First, the decoupling score uses single-wave snapshots; a trajectory-based metric measuring the rate of divergence would be theoretically superior and is the priority next step. Second, composite domains rely on available HRS proxies (for example, social connection is derived from partner status, household size, and sibling count) rather than purpose-built scales, which underestimate the richness of the underlying constructs. Third, the data structure introduces missingness that is not missing-at-random with respect to wave: several psychosocial modules, notably the Leave-Behind questionnaire that supplies life satisfaction, are not administered at every wave or to every respondent, which restricts the validation sample (Figure 3, panel b; $n = 12,971$ versus $251,648$) and produces wave-dependent missing-data patterns that can affect trajectory estimates. Fourth, descriptive trajectory and gradient estimates pool repeated person-waves; although the predictive models use one baseline observation per person, the descriptive confidence intervals do not account for within-person correlation, and a random-intercept mixed-effects specification is the appropriate extension. Fifth, conditioning on survival to later waves induces selection that attenuates late-life estimates, so the reported tertile gaps are conservative. Sixth, the framework is anchored to U.S. statutory structures (Social Security, Medicare); the core decoupling logic is portable, but the specific intervention and policy pathways are U.S.-specific. Finally, the solution-landscape review synthesizes a heterogeneous and rapidly evolving market from public, non-peer-reviewed sources, and the three prioritized interventions are derived from the decoupling framework rather than from completed trials; randomized evidence for the specific digital implementations is the essential next step.

4.6 Conclusion

For the 100 million Americans aged 55 and over, and especially for the 42 million in the pre-retirement Actionable Decade, aging is, in the first instance, a problem of detecting which life domains are quietly diverging and acting on them before the window closes. Within-person decoupling provides a measurable, age-orthogonal, and prospectively valid signal for that task. Aging, supported well, is not a trajectory of decline to be managed but a flourishing to be enabled, and the task ahead is to build the unobtrusive, equitable, evidence-generating tools that let more people follow it.

Declaration of AI Use

The authors used Claude (Anthropic) to assist with data analysis, figure preparation, and manuscript drafting and editing. The authors reviewed all content and take full responsibility for the work..

References

- Alimujiang, A., Wiensch, A., Boss, J., Fleischer, N. L., Mondul, A. M., McLean, K., Mukherjee, B., & Pearce, C. L. (2019). Association between life purpose and mortality among US adults older than 50 years. *JAMA Network Open*, 2(5), e194270. <https://doi.org/10.1001/jamanetworkopen.2019.4270>
- Alzheimer's Association. (2025). 2025 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*, 21(4).
- America's Health Rankings, United Health Foundation. (2025). 2025 Senior Report: Executive brief. Minnetonka, MN: United Health Foundation. <https://www.americashealthrankings.org/learn/reports/2025-senior-report>
- Baltes, P. B., & Smith, J. (2003). New frontiers in the future of aging: From successful aging of the young old to the dilemmas of the fourth age. *Gerontology*, 49(2), 123–135.

- Byers, A. L., Yaffe, K., Covinsky, K. E., Friedman, M. B., & Bruce, M. L. (2010). High occurrence of mood and anxiety disorders among older adults: The National Comorbidity Survey Replication. *Archives of General Psychiatry*, 67(5), 489–496.
- Carstensen, L. L. (2021). Socioemotional selectivity theory: The role of perceived endings in human motivation. *The Gerontologist*, 61(8), 1188–1196.
- Centers for Disease Control and Prevention. (2024). Changes in suicide mortality, 2022–2023 (NCHS Data Brief No. 541). National Center for Health Statistics.
- Watson, K. B., Wiltz, J. L., Nhim, K., Kaufmann, R. B., Thomas, C. W., & Greenlund, K. J. (2025). Trends in Multiple Chronic Conditions Among US Adults, By Life Stage, Behavioral Risk Factor Surveillance System, 2013–2023. *Preventing chronic disease*, 22, E15.
- Dorr, D. A., Ross, R. L., Cohen, D. J., et al. (2024). The extent and burden of high multimorbidity on older adults in the US: A descriptive analysis of Medicare beneficiaries. *BMC Geriatrics*, 24, 412.
- Federal Interagency Forum on Aging-Related Statistics. (2024). Older Americans 2024: Key indicators of well-being. Washington, DC: U.S. Government Printing Office. <https://agingstats.gov>
- Jalali, A., Ziapour, A., Karimi, Z., et al. (2024). Global prevalence of depression, anxiety, and stress in the elderly population: A systematic review and meta-analysis. *BMC Geriatrics*, 24(1), 809.
- Trends in Loneliness Among Older Adults from 2018–2023. (2023, March 13). *National Poll on Healthy Aging*. University of Michigan Institute for Healthcare Policy and Innovation.
- Neugarten, B. L. (1974). Age groups in American society and the rise of the young-old. *The Annals of the American Academy of Political and Social Science*, 415(1), 187–198.
- Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *The Gerontologist*, 37(4), 433–440.
- Sherrington, C., Fairhall, N. J., Wallbank, G. K., et al. (2019). Exercise for preventing falls in older people living in the community. *Cochrane Database of Systematic Reviews*, 1, CD012424.
- Skou, S. T., Mair, F. S., Fortin, M., et al. (2022). Multimorbidity. *Nature Reviews Disease Primers*, 8, 48.
- SPRINT Research Group. (2015). A randomized trial of intensive versus standard blood-pressure control. *New England Journal of Medicine*, 373(22), 2103–2116.
- Stone, A. A., Schwartz, J. E., Broderick, J. E., & Deaton, A. (2010). A snapshot of the age distribution of psychological well-being in the United States. *Proceedings of the National Academy of Sciences*, 107(22), 9985–9990.
- Sulandari, S., Coats, R. O., Miller, A., Hodgkinson, A., & Johnson, J. (2024). A systematic review and meta-analysis of the association between physical capability, social support, loneliness, depression, anxiety, and life satisfaction in older adults. *The Gerontologist*, 64(11), gnae128.
- Sutin, A. R., Aschwanden, D., Luchetti, M., Stephan, Y., & Terracciano, A. (2021). Sense of purpose in life is associated with lower risk of incident dementia: A meta-analysis. *Journal of Alzheimer's Disease*, 83(1), 249–258.
- Trica, A., Golu, F., Sava, N. I., Licu, M., Zanzfirescu, S. A., Adam, R., & David, I. (2024). Resilience and successful aging: A systematic review and meta-analysis. *Acta Psychologica*, 248, 104357.
- U.S. Census Bureau. (2023). Projected population by age group and sex for the United States: 2022 to 2100. Washington, DC: U.S. Census Bureau.
- United Nations, Department of Economic and Social Affairs, Population Division. (2022). World population prospects 2022. New York: United Nations.
- VanderWeele, T. J., Johnson, B. R., Bialowolski, P. T., et al. (2025). The Global Flourishing Study: Study profile and initial results on flourishing. *Nature Mental Health*, 3, 636–653. <https://doi.org/10.1038/s44220-025-00423-5>
- Wood, R. E., & Pachana, N. A. (2025). The role of meaning in the retirement transition: A scoping review. *The Gerontologist*, 65(6), gna076.
- World Health Organization. (2021). Decade of Healthy Ageing 2021–2030. Geneva: World Health Organization.

Appendix A · RAND HRS variable-to-domain mapping

Each sub-dimension below was recoded so that higher values indicate better function, then z-scored against the full HRS 50+ pool (mean 0, SD 1). The Decoupling Score (Section 2.3) is the within-person standard deviation across the available z-scored domains, requiring at least five of the seven to be present. Variable names follow RAND HRS conventions, where {w} denotes the wave-specific prefix.

Sub-dimension	Pillar	RAND HRS variable(s)	Transformation (higher = better function)
Physical health	Physical	R{w}CONDE	Negated count of chronic conditions (0–8)
Functional ability	Physical	R{w}ADL5A, R{w}IADL5A, R{w}MOBILA	Negated sum of ADL, IADL, and mobility difficulties
Cognition	Physical	R{w}COGTOT	TICS cognition total (0–35)
Mental health	Psychological	R{w}CESD	Negated CES-D depressive-symptom count (0–8)
Social connection	Psychological	R{w}MSTAT, H{w}HHRES, R{w}LIVSIB	Mean z of partner status, co-residents, and living siblings
Financial security	Financial / Env.	H{w}ATOTW	Signed log of total household wealth
Housing / environment	Financial / Env.	H{w}ATOTH, R{w}NHMLIV	Mean z of homeownership and not-in-nursing-home status

Appendix A. Composite domains (social connection, housing/environment) are constructed from available RAND HRS proxies rather than purpose-built scales; this is a recognized limitation (Section 4.5). The Leave-Behind life-satisfaction module used for external validation (Figure 3, panel b) is administered to a rotating subsample and is therefore not available at every wave.