DECISION, LEARNING, AND HUMAN DEVELOPMENT
2026, VOL. 1, NO. 1, 11 - 22
https://doi.org/10.70211/dlhd.v1i1.9
e-ISSN: 3164-7030
KALIDAKA JOURNALS | RESEARCH ARTICLE
OPEN ACCESS Check for updates

Indonesia's Ageing Transition Toward 2030: A Life-Course Projection Analysis of Old-Age Dependency and Healthy-Ageing Pressure

Muhammad Aridan[1,2] and Auwliya Khairun Nisa[1]
[1] WISE Pendidikan Indonesia, Indonesia
[2] Universitas Negeri Surabaya, Indonesia

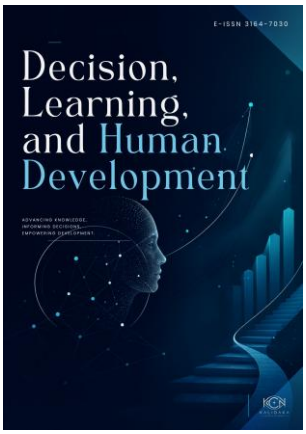
ABSTRACT

Indonesia is entering an accelerated phase of population ageing, but the near-term demographic shift is rarely interpreted as the downstream result of life-course exposures and capacities. This study projects Indonesia's ageing pressure to 2030 using a secondary-data projection-based population design anchored in the official BPS 2020-2050 cohort-component projections, externally checked against the 2025 Intercensal Population Survey (SUPAS), and interpreted through Indonesian longitudinal and international life-course evidence. Outcomes were the number and share of people aged 65 years or older, the old-age dependency ratio (OADR), the total dependency ratio, the official scenario envelope, and a Functional-Ageing Pressure Index (FAPI) used as a transparent policy stress-test. The population aged 65+ is projected to rise from 21.58 million in 2025 to 27.58 million in 2030 (+27.80%), while OADR increases from 11.00 to 13.58 (+23.43%). The 2030 official scenario range for the 65+ population is narrow (27.58-27.83 million), indicating substantial demographic lock-in. The 2025 total-population projection differs from SUPAS by only about 0.08%. Even with a 10% reduction in per-capita functional need, FAPI remains 11.09% above the 2025 baseline. Indonesia therefore requires a life-course healthy-ageing strategy that reduces later-life functional need before demographic ageing intensifies further.

IMPACT STATEMENT

Most Indonesians who will be aged 65 years or older in 2030 are already alive, so the near-term size of the older population is largely fixed. The policy question is therefore not whether ageing will occur, but in what state of health, functional ability, and social support cohorts will reach later life. The analysis shows that even meaningful reductions in per-person functional need may not fully offset demographic pressure. Investments in early-life nutrition, education, non-communicable disease prevention, decent work, social protection, pre-old-age screening, age-friendly environments, and integrated care should be treated as one connected healthy-ageing pathway.

ARTICLE HISTORY
Received: 10 April 2026
Revised: 5 June 2026
Accepted: 18 June 2026
Published: 30 June 2026
KEYWORDS
life course; healthy ageing; population ageing; old-age dependency; Indonesia



CONTACT Muhammad Aridan m_aridan@wiseedu.co.id | WISE Pendidikan Indonesia, Indonesia

© 2026 The Author(s). Published by WISE Pendidikan Indonesia. This is an Open Access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), permitting use, distribution, and reproduction provided the original work is properly cited.

1. Introduction

Population ageing is reshaping health systems, labour markets, social protection, and family life worldwide. The contemporary healthy-ageing framework shifts attention away from disease counts alone toward functional ability, the interaction between intrinsic capacity and environments, and the capacity to continue doing what people value in later life [1]. At the same time, demographic ageing is not a short-term shock: it is the cumulative result of long-run declines in fertility and mortality and the movement of large cohorts through the age structure, creating policy challenges that can persist for decades [2].

Indonesia is now moving through this transition at a speed that makes the period to 2030 analytically important. The official Population Projections of Indonesia 2020-2050 use a cohort-component approach built from fertility, mortality, and migration assumptions to estimate future population size and age structure [3]. Subsequent evidence from SUPAS 2025 reported a population of about 284.67 million, a total fertility rate of 2.13, a dependency ratio of 45.05, and an older-person share (age 60+) of 11.97%, confirming that Indonesia is already in an ageing-population phase [4]. The national Statistics of Aging Population 2025 further frames ageing as a multidimensional issue spanning health, education, economic activity, social conditions, protection, and empowerment [5]. This policy and demographic context aligns with the United Nations Decade of Healthy Ageing, which calls for research and action that connect individual capacities with social and service environments [6].

A central weakness in many near-term ageing analyses is that demographic projection and life-course theory are treated as separate domains. Life-course epidemiology explains adult and later-life health as the product of exposures and transitions that accumulate from gestation and childhood through adolescence, working life, and old age [7]. Related work emphasizes critical and sensitive periods, accumulation of risk, and chains of risk across time [8]. Cumulative advantage/disadvantage theory shows how social inequality can widen through repeated exposure to unequal resources and hazards [9], while cumulative inequality theory links early disadvantage, social stratification, and later-life health heterogeneity [10]. Life Course Health Development extends these ideas by conceptualizing health as an emergent capacity that develops dynamically across biological, behavioural, psychological, social, and environmental contexts [11].

These perspectives are directly relevant to healthy ageing. Healthy ageing is best understood as the preservation of functional ability rather than the absence of all disease [12]. Intrinsic capacity - including locomotion, cognition, vitality, psychological capacity, and sensory function - provides a useful bridge between life-course exposures and later-life functioning [13]. A cohort may therefore reach age 65 in very different states of health depending on earlier nutrition, education, socioeconomic position, health behaviours, chronic-disease prevention, employment conditions, social relationships, and access to care. This distinction matters because a rapidly growing number of older adults does not mechanically translate into an equivalent growth in dependency if functional need can be compressed; conversely, demographic pressure can be amplified if disability and multimorbidity expand.

1.1. Research problem and gap

The unresolved problem is not whether Indonesia will age, but how to interpret the near-term increase in older cohorts in a way that is both demographically credible and useful for life-course policy. Conventional population projections quantify age-structure change but do not, by themselves, indicate how much functional support older cohorts will require. Individual-level ageing studies identify behavioural, socioeconomic, cognitive, physical, and social correlates of later-life health, but they are rarely integrated with the scale and timing of national demographic change. As a result, policymakers may underestimate a key asymmetry: the number of people who will be 65+ in 2030 is largely determined by cohorts already alive, whereas their future functional need remains more modifiable through prevention, health care, social policy, and supportive environments.

This article addresses that gap by combining four analytical layers: (i) official age-structured demographic projection; (ii) external validation against a newly observed 2025 population point; (iii) life-course interpretation using Indonesian longitudinal and comparative evidence; and (iv) a transparent Functional-Ageing Pressure Index (FAPI) that stress-tests how changes in per-capita functional need would interact with rising old-age dependency. FAPI is deliberately not presented as a disability-prevalence forecast. It is a policy threshold device designed to make the scale of demographic pressure explicit without fabricating individual-level transition probabilities.

1.2. Research objectives and questions

The study aims to estimate Indonesia's near-term ageing transition to 2030 and interpret its implications through a life-course healthy-ageing framework. Three research questions guide the

analysis: RQ1, how do the population aged 65+, the age composition, OADR, and total dependency ratio change between 2025 and 2030? RQ2, how large is the official 2030 scenario spread relative to the structural increase in the population aged 65+ from 2025 to 2030? RQ3, how large would changes in per-capita functional need have to be to offset the demographic increase in OADR?

2. Literature review

2.1. Indonesian evidence on later-life capacity and inequality

Existing Indonesian evidence strongly supports a life-course reading of later-life functioning. Social capital has been associated with healthier ageing among older Indonesians [14], and longitudinal evidence suggests that health-related behaviours and behavioural change are linked with successful ageing outcomes [15]. Seven-year findings from middle-aged and older adults show that pain can have persistent consequences for functional health [16], while handgrip strength varies systematically with sociodemographic and health characteristics [17]. Hypertension also displays substantial socioeconomic patterning, indicating that cardiovascular risk is socially structured rather than randomly distributed [18].

Cognitive and mental-health pathways similarly extend across the life course. Childhood health and socioeconomic status have been linked with later dementia risk in analyses using Indonesian survey data [19]. Socioeconomic disadvantage helps explain cognitive differences in later life [20], while education has longitudinal associations with depression [21]. Multilevel work connects social capital to mental health among older adults [22], and recent evidence on insomnia demonstrates intersections among mental health, socioeconomic status, and physical function [23]. These studies collectively indicate that later-life capacity is produced by cumulative and interacting domains rather than by chronological age alone.

The functional consequences are regionally important. A systematic review and meta-analysis across ASEAN countries identifies functional disability as a major issue among older adults [24]. Cross-national evidence also shows socioeconomic gradients in handgrip strength and other dimensions of intrinsic capacity [25]. Life-course inequality in intrinsic capacity has been documented in middle-income settings [26], and a recent systematic review of longitudinal research reinforces the association between socioeconomic position across the life course and healthy ageing outcomes [27]. Although these findings cannot be converted directly into national Indonesian transition probabilities without microdata modelling, they provide a strong mechanistic basis for interpreting demographic ageing through differential functional need.

2.2. Cumulative pathways from social conditions to healthy ageing

The theoretical mechanism is broader than health services. Social determinants shape exposures to nutrition, education, housing, work, environmental hazards, and access to resources over decades [28]. Large multicohort evidence indicates that socioeconomic status can be as consequential for mortality as several established behavioural risk factors [29]. As cohorts age, the burden of chronic disease becomes increasingly important for health policy [30], particularly because multimorbidity is common and complicates service delivery, clinical decision-making, and self-management [31], [32].

Life-course pathways also operate through domains that are sometimes omitted from ageing policy. Oral health is increasingly recognized as part of healthy ageing because it affects nutrition, communication, pain, and social participation [33], [34]. Cardiovascular ageing reflects biological and social processes that accumulate across life [35], while multicohort evidence links life-course socioeconomic disadvantage to poorer lung function [36]. Social position is also associated with life satisfaction across different welfare-state contexts [37], and sociological research demonstrates how social inequality and health remain mutually reinforcing across adulthood [38].

The 'linked lives' principle adds a family and intergenerational dimension: later-life outcomes are connected to spouses, adult children, caregivers, and multigenerational resource flows, which can reproduce or buffer cumulative inequality [39]. Earlier successful-ageing frameworks highlighted low disease burden, high function, and active engagement [40]; contemporary healthy-ageing approaches broaden this view by recognizing environmental support and adaptation. At the macro level, population ageing has implications for labour supply, savings, public expenditure, and social protection, making healthy ageing a development issue rather than only a geriatric-health issue [41]. Figure 1 summarizes this integrated life-course pathway.

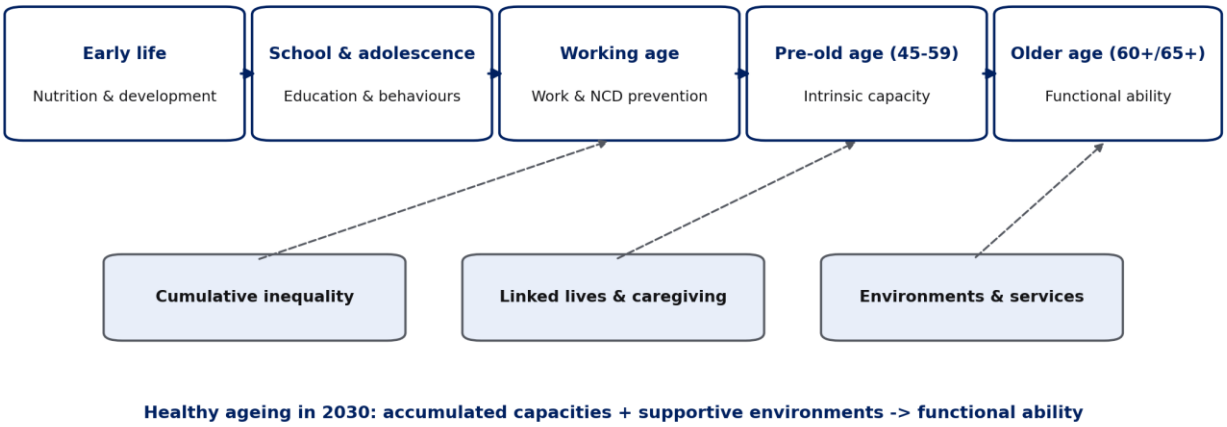


Figure 1. Life-course pathways linking cumulative exposures and supports to functional ability in later life.

Note. Conceptual synthesis developed for this study. NCD = non-communicable disease.

3. Methods

3.1. Research design

This study used a secondary-data projection-based population design with life-course evidence triangulation. The primary quantitative engine was the official BPS cohort-component projection rather than a machine-learning model because the research questions concern how already-existing cohorts move through the national age structure. The analysis period focused on 2025 and 2030, with 2025 treated both as the baseline projection year and as a validation point once SUPAS 2025 observations became available. Life-course mechanisms were triangulated from Indonesian and international peer-reviewed evidence rather than estimated as new individual-level coefficients.

The Indonesia Family Life Survey (IFLS) provides the principal longitudinal context for the Indonesian life-course interpretation. IFLS follows households, individuals, communities, and facilities and was designed to represent approximately 83% of the Indonesian population across 13 provinces at baseline [42]. In this article, however, raw IFLS microdata were not re-analysed. Published IFLS-based studies were used only to substantiate plausible mechanisms linking earlier exposures with later physical, cognitive, mental-health, and social outcomes. This separation prevents mechanistic evidence from being misrepresented as an estimated national transition model.

3.2. Data universe and analytical units

The analytical universe consisted of national-level Indonesian population totals and broad age groups (0-14, 15-64, and 65+) for 2025 and 2030. The primary scenario was the BPS trend scenario. The official moderate and optimistic policy scenarios were used to construct a 2030 scenario envelope. SUPAS 2025 provided an external observed total population and dependency-ratio check. Additional BPS, WHO, Bappenas, and peer-reviewed sources were used to contextualize healthy ageing, service integration, and life-course mechanisms. No new human participants were recruited, sampled, or contacted. Table 1 summarizes the data sources and their analytical roles.

Table 1. Data sources and analytical role.

Source	Period / coverage	Role in this study
BPS Population Projections 2020-2050	National, 2020-2050	Primary age-structured projection; trend, moderate, and optimistic scenarios
SUPAS 2025	National, 2025	External validation of total population and dependency ratio
Statistics of Aging Population 2025 / Susenas / Sakernas	National, 2025	Context for multidimensional ageing and current older-population conditions
IFLS-based peer-reviewed evidence	Longitudinal Indonesian evidence	Mechanistic life-course triangulation; no new coefficient estimation
WHO and Bappenas policy sources	Healthy ageing and service policy	Interpretation of functional ability and policy implications

3.3. Operational definitions / Variables

The operational definitions used in the analysis are summarized in Table 2.

Table 2. Operational definitions of the principal indicators.

Indicator	Definition / calculation	Interpretive role
Population aged 65+	Number of residents aged 65 years or older	Core demographic ageing outcome
Share aged 65+	P65+ / total population x 100	Age-structure intensity
Old-age dependency ratio (OADR)	P65+ / P15-64 x 100	Older persons per 100 working-age persons
Total dependency ratio (DR)	(P0-14 + P65+) / P15-64 x 100	Broad age-structure dependency signal
Scenario envelope	Minimum-to-maximum 2030 outcome across official scenarios	Deterministic projection uncertainty
Functional-Ageing Pressure Index (FAPI)	OADR change multiplied by a per-capita need factor q; 2025 = 100	Policy stress-test, not disability prevalence

3.4. Data collection and extraction

Population counts were extracted from the BPS 2020-2050 projection tables for 2025 and 2030 and aggregated into the three broad age groups required for dependency calculations. The analysis maintained a strict distinction between age 60+ and age 65+: SUPAS reports the share of older persons using age 60+, whereas the OADR in this study uses age 65+ to maintain comparability with standard demographic practice. The BPS Statistics of Aging Population 2025 integrates Susenas, Sakernas, population-census/projection, and other government sources, illustrating the breadth of nationally available ageing information [5].

3.5. Data analysis

The cohort-component outputs were treated as scenario-based projections, not as stochastic point forecasts. This distinction is important because modern probabilistic population projection methods explicitly propagate uncertainty in fertility, mortality, and migration [43], [44], [45]. The present analysis did not reconstruct those posterior distributions; instead, uncertainty was communicated through the official deterministic scenario envelope.

All derived indicators were calculated from the reported age-group counts. Percentage change was computed as (value2030 - value2025) / value2025 x 100. The scenario spread was defined as the difference between the maximum and minimum official 2030 values. FAPI was normalized to 100 in 2025 and stress-tested under three transparent per-capita functional-need assumptions: q = 0.90 (healthy compression), q = 1.00 (status quo), and q = 1.10 (adverse expansion). The break-even value of q was solved algebraically as the value required to keep FAPI2030 at 100.

3.6. Validation, reliability, and uncertainty

External validation used the observed SUPAS 2025 total population to calculate absolute percentage error (APE) for the earlier BPS projection. The 2025 total dependency ratio was also compared directly with the SUPAS estimate. Because the study evaluates aggregate cohort-component outputs rather than an individual-level prediction model, validation was confined to demographic quantities that could be observed directly and compared on the same scale.

Reliability was strengthened through reproducible arithmetic, internal consistency checks across population totals and age-group sums, explicit separation of observed versus projected values, and sensitivity analysis across official scenarios. Because the scenario envelope is deterministic, it should not be interpreted as a confidence interval. The analysis also avoids converting published associations from IFLS-based studies into national causal effects or transition probabilities.

3.7. Ethical considerations

The study used only publicly available aggregate statistics and published research. No identifiable individual-level data were accessed, and no new contact with human participants occurred. Institutional ethics review and informed consent were therefore not required for this secondary aggregate-data analysis.

4. Results and Discussion

4.1. Results

4.1.1. Structural ageing trajectory, 2025-2030

The projected age structure changes unevenly over the five-year period. Total population rises from 284.44 million in 2025 to 297.43 million in 2030 (+4.57%). The population aged 0-14 is almost unchanged (+0.06%), and the 15-64 population grows by 3.54%. In contrast, the 65+ population increases from 21.58 million to 27.58 million, an increase of 6.00 million or 27.80%. Consequently, the share aged 65+ rises from 7.59% to 9.27%. The magnitude of the 65+ increase is therefore about six times the percentage growth of the total population. Table 3 reports the projected values, while Figure 2 visualizes the corresponding shift in broad age composition.

Table 3. Projected population structure and dependency indicators, 2025-2030.

Indicator	2025	2030	Change
Total population	284.44 million	297.43 million	+4.57%
Population aged 0-14	66.72 million	66.77 million	+0.06%
Population aged 15-64	196.13 million	203.08 million	+3.54%
Population aged 65+	21.58 million	27.58 million	+27.80%
Share aged 65+	7.59%	9.27%	+1.69 percentage points
OADR	11.00	13.58	+23.43%
Total dependency ratio	45.02	46.46	+1.43 points

Note. Authors' calculations from BPS cohort-component projection values provided in the study dataset. OADR = old-age dependency ratio.

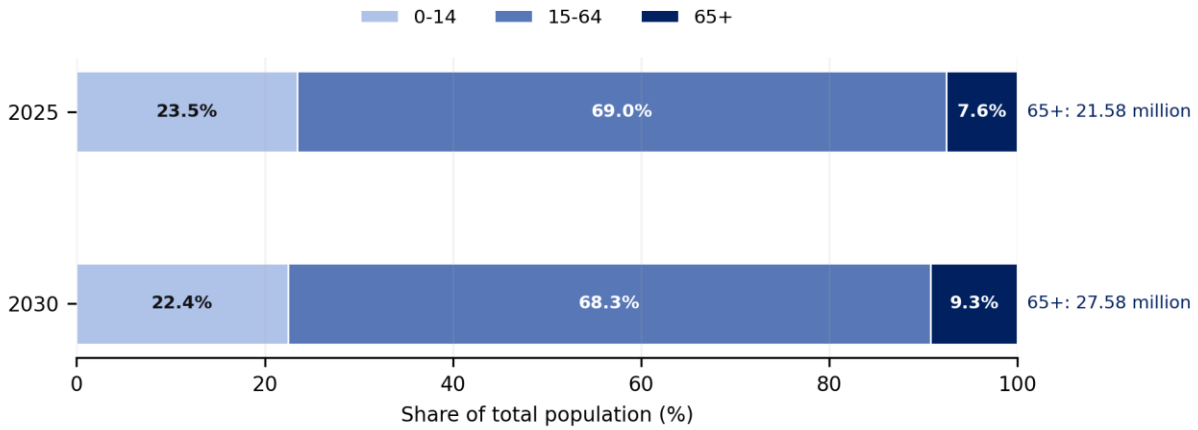


Figure 2. Shift in Indonesia's broad age composition between 2025 and 2030.

Note. Percent shares are calculated from the projected national age-group totals. The 65+ population rises from 21.58 to 27.58 million.

The OADR rises from 11.00 to 13.58, equivalent to an increase of 23.43%. In intuitive terms, there are about 11 people aged 65+ per 100 people aged 15-64 in 2025, increasing to about 13.6 per 100 in 2030. OADR is not an individual economic dependency measure: not all people aged 65+ are dependent, and not all people aged 15-64 are economically active. Its value here is structural. It captures the speed at which the older population grows relative to the conventional working-age denominator.

4.1.2. Scenario envelope and demographic lock-in

The three official scenarios yield very similar 2030 counts for the population aged 65+. Under the trend scenario, the 65+ population is 27.58 million; the moderate policy scenario produces 27.74 million; and the optimistic policy scenario produces 27.83 million. The full range is therefore approximately 0.25 million. By comparison, the structural increase from 2025 to the 2030 trend scenario is 6.00 million. The five-year cohort-driven increase is roughly 24 times larger than the scenario spread at the 2030 endpoint. Table 4 reports the full scenario envelope, and Figure 3 visualizes the narrow spread relative to the trend scenario.

Table 4. Official 2030 scenario envelope.

BPS scenario	Total population	Population 65+	Share 65+	OADR	Total DR
Trend	297.43 million	27.58 million	9.27%	13.58	46.46

BPS scenario	Total population	Population 65+	Share 65+	OADR	Total DR
Moderate	297.88 million	27.74 million	9.31%	13.65	46.64
Optimistic	298.03 million	27.83 million	9.34%	13.70	46.68

Note. Scenario labels follow the BPS trend, moderate-policy, and optimistic-policy structure. The narrow 65+ envelope reflects the fact that most individuals who will be 65+ in 2030 are already alive.

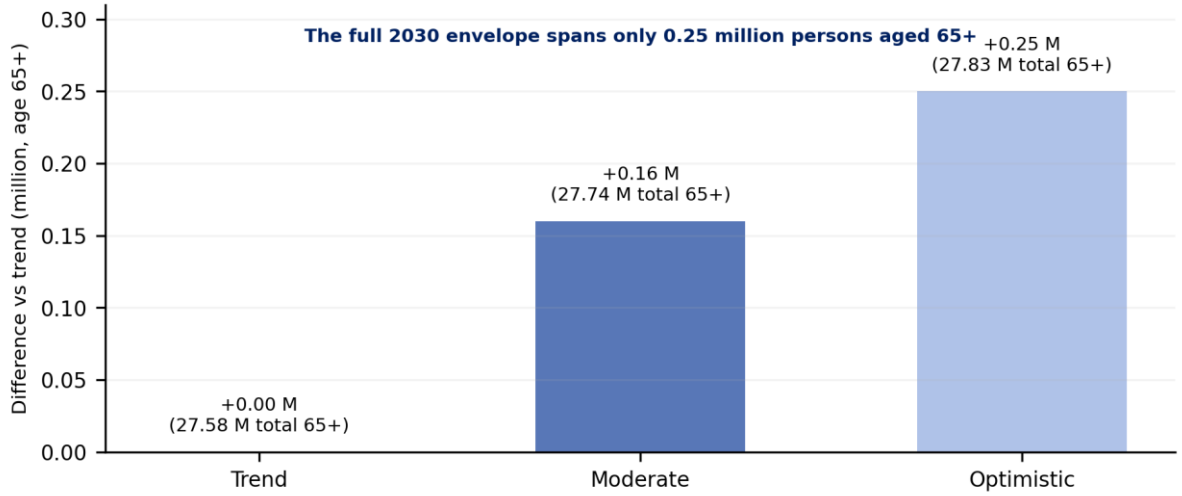


Figure 3. Scenario spread in the population aged 65+ relative to the 2030 trend scenario.

This pattern answers RQ2 and is interpreted as demographic lock-in. Fertility assumptions in the late 2020s can strongly affect child cohorts and the distant future age structure, but they cannot materially change the number of people reaching age 65 by 2030. Mortality and migration assumptions can affect the precise level, but the near-term 65+ count remains tightly constrained by cohort size. The resulting policy implication is subtle: uncertainty about how many older persons will exist in 2030 is relatively small compared with uncertainty about their health, functioning, care needs, and distribution across families and regions.

4.1.3. External validation against SUPAS 2025

The BPS trend projection for 2025 was 284.439 million, while SUPAS 2025 later estimated approximately 284.67 million. The difference is about 0.231 million, producing an APE of approximately 0.081%. The projected total dependency ratio of 45.02 is also close to the SUPAS estimate of 45.05, a difference of only 0.03 points. These comparisons do not prove that every age-specific projection is error-free, but they provide an unusually timely external check showing that the aggregate short-horizon baseline is well aligned with a subsequent national observation. The validation results are summarized in Table 5.

Table 5. External validation of the 2025 projection against SUPAS 2025.

Metric	BPS projection 2025	SUPAS 2025 observed	Difference / error
Total population	284.439 million	~284.67 million	APE ~0.081%
Total dependency ratio	45.02	45.05	0.03 points
TFR	Not used as outcome	2.13	Contextual validation
Older-person share	Study uses age 65+	11.97% at age 60+	Not directly comparable

4.1.4. Functional-Ageing Pressure Index stress-test

If per-capita functional need remains unchanged (q = 1.00), FAPI rises to 123.43 in 2030, tracking the increase in OADR. Under healthy compression, where average functional need per older person is assumed to fall by 10% (q = 0.90), FAPI still reaches 111.09. Under adverse expansion (q = 1.10), FAPI rises to 135.77. Thus, a meaningful 10% improvement in per-person need would slow aggregate pressure but would not fully offset the demographic increase. Table 6 reports the three stress-test values, and Figure 4 illustrates their magnitude relative to the 2025 baseline.

Table 6. Functional-Ageing Pressure Index stress-test for 2030.

Per-capita functional-need state	q	FAPI 2030 (2025 = 100)	Interpretation
Healthy compression	0.90	111.09	Per-person need falls 10%, but aggregate pressure remains about 11% higher
Status quo	1.00	123.43	Aggregate pressure follows the OADR increase
Adverse expansion	1.10	135.77	Demography and per-person need worsen together

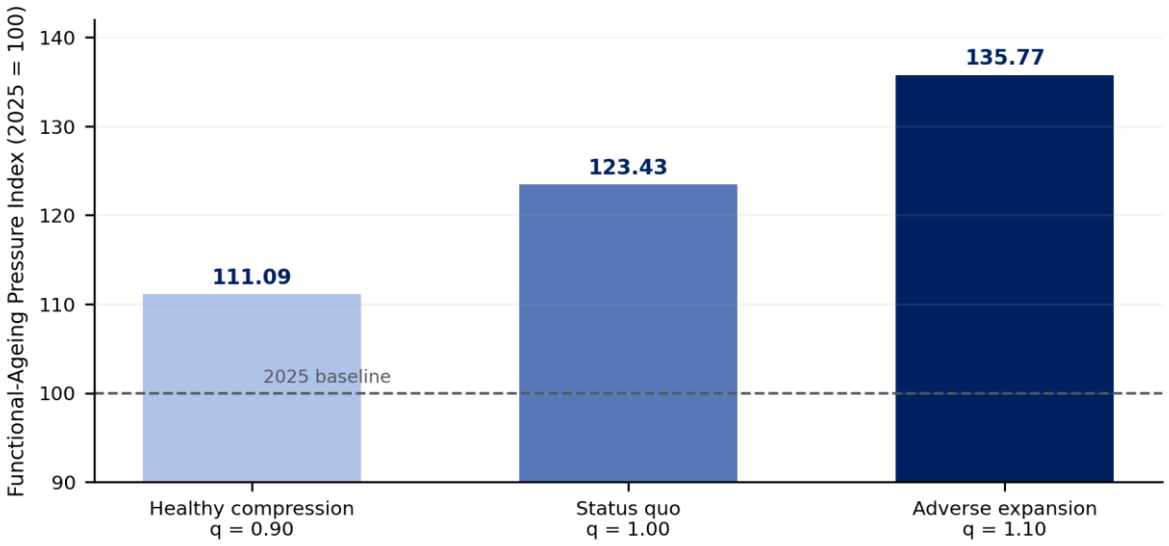


Figure 4. Functional-Ageing Pressure Index under three per-capita need scenarios.

Solving Equation (3) for FAPI2030 = 100 gives a break-even q of approximately 0.81. In other words, average per-capita functional need would need to be about 19% lower than the 2025 baseline merely to keep the aggregate pressure index constant. This 19% value is not a forecast of program effectiveness; it is a threshold that quantifies how large functional compression would have to be to offset the demographic change in OADR by 2030.

4.2. Discussion

4.2.1. From demographic lock-in to life-course modifiability

The results answer all three research questions and clarify their policy significance. Indonesia's near-term ageing is structurally strong: a 27.80% increase in the 65+ population occurs while the child population is essentially flat and the working-age population grows only modestly. At the same time, the scenario envelope for the 65+ count is narrow. The main planning uncertainty is therefore less about the existence of a larger older population than about the capacities and needs that cohorts will carry into later life.

This is precisely where life-course theory adds value to demographic projection. The 2030 cohort cannot be made numerically younger through policies implemented today, but its later-life functional trajectory can still be influenced. For people currently in their late 50s and early 60s, hypertension control, diabetes management, physical activity, nutrition, mental-health care, fall prevention, oral health, rehabilitation, and social participation can affect near-term intrinsic capacity and functional ability. For younger cohorts, the intervention horizon is longer and includes education, employment quality, social protection, tobacco prevention, and cumulative socioeconomic conditions. The demographic lock-in is therefore paired with a functional modifiability: cohort size is largely fixed, but the distribution of later-life capacity is not.

Indonesia's policy direction is increasingly compatible with this interpretation. In 2026, Bappenas explicitly emphasized a life-cycle, intergenerational, ageing-in-place, healthy-ageing, and cross-sectoral paradigm for responding to the transition toward an ageing society [46]. WHO's Integrated Care for Older People (ICOPE) framework provides a service-level pathway for person-centred assessment and management of declines in intrinsic capacity [47]. At the community level, Indonesia's Integrated Elderly Services (Layanan Lansia Terintegrasi, LLT) are intended to connect older people

and families with health services, social protection, and opportunities for participation [48]. The present analysis suggests that such later-life services should be complemented by upstream investments across earlier life stages.

4.2.2. Policy architecture across the life course

A life-course ageing policy should distinguish interventions by timing while maintaining a common outcome: preserving functional ability and reducing avoidable need. Early-life nutrition and maternal-child health influence physical and cognitive reserves. Schooling and adolescence shape educational attainment, health literacy, mental health, physical activity, and tobacco exposure. Working-age policy influences chronic-disease risk, income security, work-related hazards, and access to preventive care. The pre-old-age period (approximately 45-59 years) is a strategic window for detecting declining intrinsic capacity before severe dependency emerges. In older age, integrated primary care, rehabilitation, long-term care, caregiver support, social participation, and age-friendly environments become increasingly important. Table 7 summarizes this life-course policy architecture.

Table 7. Life-course policy architecture for healthy ageing toward 2030 and beyond.

Life stage	Priority interventions	Expected long-run pathway
Pregnancy and early childhood	Maternal-child health, nutrition, poverty reduction, early development	Build physical and cognitive reserve
School and adolescence	Education, mental health, physical activity, tobacco prevention, health literacy	Strengthen human capital and protective behaviours
Working age	NCD prevention, decent work, income security, social protection, preventive care	Delay chronic disease and cumulative disadvantage
Pre-old age (45-59)	Intrinsic-capacity screening, cognition/function checks, risk management, rehabilitation	Compress functional need before entry into older age
Older age	Integrated primary care, ICOPE-aligned assessment, rehabilitation, LLT/LTC, caregiver support	Maintain functional ability and participation

The FAPI threshold gives this policy architecture a quantitative interpretation. If average functional need in 2030 were only 10% lower than in 2025, aggregate pressure would still be about 11% higher because demography is moving faster than that improvement. This does not imply that prevention is ineffective; rather, it shows why prevention must be broad, sustained, and combined with service-capacity expansion. Healthy ageing should therefore be evaluated not only by changes in individual risk factors but also by whether reductions in functional need are large enough to counterbalance the pace of structural ageing.

4.2.3. Methodological implications, limitations, and future research

The study has four main limitations. First, the BPS outputs are scenario projections rather than posterior probability distributions; the reported scenario envelope therefore does not represent a confidence interval. Second, FAPI is intentionally a stress-test and should not be interpreted as disability prevalence, long-term-care demand, or expenditure. Third, published IFLS-based studies were used for mechanistic triangulation, but raw IFLS microdata were not re-analysed to estimate new transition parameters. Fourth, the national model masks provincial heterogeneity in ageing speed, health infrastructure, family structure, socioeconomic conditions, and migration.

These limitations also define the next research agenda. A strong extension would combine province-specific cohort projections with multistate or microsimulation transitions such as healthy -> NCD -> multimorbidity -> IADL limitation -> ADL dependency -> long-term care -> death. Transition probabilities could be estimated from longitudinal microdata, stratified by socioeconomic position, sex, geography, and other life-course exposures, and then calibrated to national and provincial demographic projections. Probabilistic uncertainty could be propagated through fertility, mortality, migration, and functional transitions. Such a model would move from the present transparent demographic stress-test toward a genuine forecast of functional-care demand.

A further strength of the current design is its separation of evidence types. Demographic counts are reported as projections; SUPAS is used as an observed validation point; published life-course evidence is used to explain plausible mechanisms; and FAPI is labelled as a scenario-based threshold tool. Maintaining these distinctions reduces the risk of false precision and makes the article more reproducible than an ostensibly sophisticated predictive model built without access to the required microdata and transition matrices.

5. Conclusion

Indonesia's ageing transition to 2030 is both rapid and, in the near term, substantially locked into cohorts already alive. The population aged 65+ is projected to increase from 21.58 million in 2025 to 27.58 million in 2030, while OADR rises from 11.00 to 13.58. The official 2030 scenario envelope for the 65+ population is small relative to this five-year structural increase, and the 2025 projection aligns closely with the subsequent SUPAS observation. A 10% reduction in per-capita functional need would moderate but not eliminate aggregate ageing pressure; the break-even threshold is approximately a 19% reduction. The policy implication is not to treat ageing as a problem that begins at age 60 or 65. Indonesia's most defensible strategy is a life-course healthy-ageing architecture that combines upstream prevention and social investment with pre-old-age risk detection, integrated later-life care, rehabilitation, caregiver support, and age-friendly environments. Future work should extend the national analysis to province-specific multistate microsimulation using longitudinal transition data.

Ethics approval statement

Ethical approval was not required because the study analyzed publicly available aggregate population statistics and published literature and did not access identifiable individual-level data.

Informed consent statement

Informed consent was not applicable because no participants were recruited or contacted and no identifiable individual-level data were used.

Author contribution statement

Muhammad Aridan: Conceptualization, Methodology, Formal analysis, Data curation, Visualization, Writing - original draft, Writing - review & editing. Auwliya Khairun Nisa: Conceptualization, Investigation, Validation, Writing - review & editing.

Acknowledgments

The authors acknowledge BPS-Statistics Indonesia, Bappenas, WHO, and the researchers who produced the longitudinal and comparative evidence synthesized in this study.

Disclosure statement

The authors declare no conflict of interest with respect to the research, authorship, or publication of this article.

AI-assisted technologies disclosure

Generative AI-assisted tools were used to support English-language editing, visualization drafting, and document formatting. The authors reviewed the calculations, source claims, references, and interpretations and remain fully responsible for the accuracy, originality, and integrity of the manuscript.

ORCID

Muhammad Aridan: https://orcid.org/0000-0001-8426-3366

Auwliya Khairun Nisa: https://orcid.org/0009-0009-0077-3963

Data availability statement

The demographic data underlying the analysis are publicly available from BPS-Statistics Indonesia. Policy documents are publicly available from Bappenas and WHO. All derived calculations required to reproduce the reported indicators are presented in the manuscript tables and equations.

References

[1] J. R. Beard, A. Officer, I. A. de Carvalho, et al., "The World report on ageing and health: a policy framework for healthy ageing," *The Lancet*, vol. 387, no. 10033, pp. 2145-2154, 2016. https://doi.org/10.1016/S0140-6736(15)00516-4.

[2] K. Christensen, G. Doblhammer, R. Rau, and J. W. Vaupel, "Ageing populations: the challenges ahead," *The Lancet*, vol. 374, no. 9696, pp. 1196-1208, 2009. https://doi.org/10.1016/S0140-6736(09)61460-4.

[3] BPS-Statistics Indonesia, Population Projections of Indonesia 2020-2050: Result of the 2020 Population Census. Jakarta, Indonesia: BPS-Statistics Indonesia, 2023, ISBN 978-602-438-521-7.

[4] BPS-Statistics Indonesia, "SUPAS 2025: The Total Fertility Rate (TFR) is 2.13, the Infant Mortality Rate (IMR) is 14.12, and the percentage of older persons has reached 11.97 percent," Official Statistics News, May 5, 2026.

[5] BPS-Statistics Indonesia, Statistics of Aging Population 2025. Jakarta, Indonesia: BPS-Statistics Indonesia, 2025.
[6] N. Keating, "A research framework for the United Nations Decade of Healthy Ageing (2021-2030)," *European Journal of Ageing*, vol. 19, no. 3, pp. 775-787, 2022. https://doi.org/10.1007/s10433-021-00679-7.
[7] Y. Ben-Shlomo and D. Kuh, "A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives," *International Journal of Epidemiology*, vol. 31, no. 2, pp. 285-293, 2002. https://doi.org/10.1093/ije/31.2.285.
[8] D. Kuh, Y. Ben-Shlomo, J. Lynch, J. Hallqvist, and C. Power, "Life course epidemiology," *Journal of Epidemiology & Community Health*, vol. 57, no. 10, pp. 778-783, 2003. https://doi.org/10.1136/jech.57.10.778.
[9] D. Dannefer, "Cumulative advantage/disadvantage and the life course: Cross-fertilizing age and social science theory," *The Journals of Gerontology: Series B*, vol. 58, no. 6, pp. S327-S337, 2003. https://doi.org/10.1093/geronb/58.6.S327.
[10] K. F. Ferraro and T. P. Shippee, "Aging and cumulative inequality: How does inequality get under the skin?," *The Gerontologist*, vol. 49, no. 3, pp. 333-343, 2009. https://doi.org/10.1093/geront/gnp034.
[11] N. Halfon, K. Larson, M. Lu, E. Tullis, and S. Russ, "Lifecourse health development: Past, present and future," *Maternal and Child Health Journal*, vol. 18, no. 2, pp. 344-365, 2014. https://doi.org/10.1007/s10995-013-1346-2.
[12] J.-P. Michel and R. Sadana, "Healthy aging concepts and measures," *Journal of the American Medical Directors Association*, vol. 18, no. 6, pp. 460-464, 2017. https://doi.org/10.1016/j.jamda.2017.03.008.
[13] M. Cesari, I. A. de Carvalho, J. A. Thiyagarajan, et al., "Evidence for the domains supporting the construct of intrinsic capacity," *The Journals of Gerontology: Series A*, vol. 73, no. 12, pp. 1653-1660, 2018. https://doi.org/10.1093/gerona/gly011.
[14] J. Cao and A. Rammohan, "Social capital and healthy ageing in Indonesia," *BMC Public Health*, vol. 16, art. no. 631, 2016. https://doi.org/10.1186/s12889-016-3257-9.
[15] L. W. Oktaviani, H.-C. Hsu, and Y.-C. Chen, "Effects of health-related behaviors and changes on successful aging among Indonesian older people," *International Journal of Environmental Research and Public Health*, vol. 19, no. 10, art. no. 5952, 2022. https://doi.org/10.3390/ijerph19105952.
[16] V. Yiengprugsawan, J. Piggott, F. Witoelar, et al., "Pain and its impact on functional health: 7-year longitudinal findings among middle-aged and older adults in Indonesia," *Geriatrics*, vol. 5, no. 2, art. no. 39, 2020. https://doi.org/10.3390/geriatrics5020039.
[17] S. Pengpid and K. Peltzer, "Hand grip strength and its sociodemographic and health correlates among older adult men and women (50 years and older) in Indonesia," *Current Gerontology and Geriatrics Research*, vol. 2018, art. no. 3265041, 2018. https://doi.org/10.1155/2018/3265041.
[18] Y. A. Mashuri, N. Ng, and A. Santosa, "Socioeconomic disparities in the burden of hypertension among Indonesian adults-a multilevel analysis," *Global Health Action*, vol. 15, no. 1, 2022. https://doi.org/10.1080/16549716.2022.2129131.
[19] T. Le, A. Lee, and J. Gilleen, "Association of childhood health and socioeconomic status with dementia risk in older age: a cross-sectional study using the Indonesia Family Life Survey 2014-2015," *BMJ Open*, vol. 15, no. 8, art. no. e093896, 2025. https://doi.org/10.1136/bmjopen-2024-093896.
[20] S. Sujarwoto, T. Yumarni, and H. Holipah, "Can socioeconomic disadvantage explain cognitive differences in later life? Insights from the Indonesia Family Life Survey," *Frontiers in Public Health*, vol. 13, 2025. https://doi.org/10.3389/fpubh.2025.1563543.
[21] B. Patria, "The longitudinal effects of education on depression: Finding from the Indonesian national survey," *Frontiers in Public Health*, vol. 10, 2022. https://doi.org/10.3389/fpubh.2022.1017995.
[22] E. Nizeyumukiza, A. C. Pierewan, and E. Ndayambaje, "Social capital and mental health among older adults in Indonesia: A multilevel approach," *Journal of Population and Social Studies*, vol. 29, pp. 1-14, 2021. https://doi.org/10.25133/jpssv292021.001.
[23] Y. S. Handajani, E. Schroder-Butterfill, and E. Hogervorst, "Insomnia in Indonesia older adults: The role of mental health, sociodemographic status, and physical function," *Sleep Medicine Research*, vol. 15, no. 2, pp. 96-105, 2024. https://doi.org/10.17241/smr.2023.02068.
[24] P. N. Yau, C. J. E. Foo, N. L. J. Cheah, et al., "The prevalence of functional disability and its impact on older adults in the ASEAN region: a systematic review and meta-analysis," *Epidemiology and Health*, vol. 44, art. no. e2022058, 2022. https://doi.org/10.4178/epih.e2022058.
[25] Y. Selvamani and R. Sadana, "Socioeconomic differences in handgrip strength and its association with measures of intrinsic capacity among older adults in six middle-income countries," *Scientific Reports*, vol. 11, 2021. https://doi.org/10.1038/s41598-021-99047-9.
[26] Y. Si, K. Hanewald, and S. Chen, "Life-course inequalities in intrinsic capacity and healthy ageing, China," *Bulletin of the World Health Organization*, vol. 101, no. 5, pp. 307-316C, 2023. https://doi.org/10.2471/BLT.22.288888.
[27] Y. Ye, C. Long, K. C. Chua, et al., "Socio-economic position and healthy ageing across the life course: a systematic review of longitudinal studies," *GeroScience*, 2026. https://doi.org/10.1007/s11357-026-02137-7.
[28] M. Marmot, S. Friel, R. Bell, T. A. J. Houweling, and S. Taylor, "Closing the gap in a generation: health equity through action on the social determinants of health," *The Lancet*, vol. 372, no. 9650, pp. 1661-1669, 2008. https://doi.org/10.1016/S0140-6736(08)61690-6.
[29] S. Stringhini et al., "Socioeconomic status and the 25x25 risk factors as determinants of premature mortality: a multicohort study and meta-analysis of 1.7 million men and women," *The Lancet*, vol. 389, no. 10075, pp. 1229-1237, 2017. https://doi.org/10.1016/S0140-6736(16)32380-7.
[30] M. Prince, F. Wu, Y. Guo, et al., "The burden of disease in older people and implications for health policy and practice," *The Lancet*, vol. 385, no. 9967, pp. 549-562, 2015. https://doi.org/10.1016/S0140-6736(14)61347-7.
[31] K. Barnett, S. W. Mercer, M. Norbury, G. Watt, S. Wyke, and B. Guthrie, "*Epidemiology* of multimorbidity and implications for health care, research, and medical education," *The Lancet*, vol. 380, no. 9836, pp. 37-43, 2012. https://doi.org/10.1016/S0140-6736(12)60240-2.
[32] A. Marengoni, S. Angleman, R. Melis, et al., "Aging with multimorbidity: A systematic review of the literature," *Ageing Research Reviews*, vol. 10, no. 4, pp. 430-439, 2011. https://doi.org/10.1016/j.arr.2011.03.003.

[33] J. Patel, J. Wallace, M. Doshi, et al., "Oral health for healthy ageing," *The Lancet Healthy Longevity*, vol. 2, no. 8, pp. e521-e527, 2021. https://doi.org/10.1016/S2666-7568(21)00142-2.
[34] P. Poudel, G. Paudel, R. Acharya, et al., "Oral health and healthy ageing: a scoping review," *BMC Geriatrics*, vol. 24, 2024. https://doi.org/10.1186/s12877-023-04613-7.
[35] R. Hardy, D. A. Lawlor, and D. Kuh, "A life course approach to cardiovascular aging," *Future Cardiology*, vol. 11, no. 1, pp. 101-113, 2015. https://doi.org/10.2217/fca.14.67.
[36] V. Rocha, S. Fraga, C. Moreira, et al., "Life-course socioeconomic disadvantage and lung function: a multicohort study of 70,496 individuals," *European Respiratory Journal*, vol. 57, no. 3, art. no. 2001600, 2021. https://doi.org/10.1183/13993003.01600-2020.
[37] C. L. Niedzwiedz, S. V. Katikireddi, J. P. Pell, and R. Mitchell, "The association between life course socioeconomic position and life satisfaction in different welfare states," *Age and Ageing*, vol. 43, no. 3, pp. 431-436, 2014. https://doi.org/10.1093/ageing/afu004.
[38] E. K. Pavalko and J. L. Caputo, "Social inequality and health across the life course," *American Behavioral Scientist*, vol. 57, no. 8, pp. 1040-1056, 2013. https://doi.org/10.1177/0002764213487344.
[39] M. Gilligan, A. Karraker, and A. Jasper, "Linked lives and cumulative inequality: A multigenerational family life course framework," *Journal of Family Theory & Review*, vol. 10, no. 1, pp. 111-125, 2018. https://doi.org/10.1111/jftr.12244.
[40] J. W. Rowe and R. L. Kahn, "Successful aging," *The Gerontologist*, vol. 37, no. 4, pp. 433-440, 1997. https://doi.org/10.1093/geront/37.4.433.
[41] D. E. Bloom, S. Chatterji, P. Kowal, et al., "Macroeconomic implications of population ageing and selected policy responses," *The Lancet*, vol. 385, no. 9968, pp. 649-657, 2015. https://doi.org/10.1016/S0140-6736(14)61464-1.
[42] RAND Corporation and SurveyMETER, Indonesia Family Life Survey (IFLS), 1993-2014/15: Longitudinal household, individual, community, and facility data. Documentation notes baseline coverage of 13 provinces, 321 enumeration areas, and approximately 83% of the Indonesian population.
[43] A. E. Raftery, N. Li, H. Sevcikova, P. Gerland, and G. K. Heilig, "Bayesian probabilistic population projections for all countries," *Proceedings of the National Academy of Sciences*, vol. 109, no. 35, pp. 13915-13921, 2012. https://doi.org/10.1073/pnas.1211452109.
[44] L. Alkema, A. E. Raftery, P. Gerland, et al., "Probabilistic projections of the total fertility rate for all countries," *Demography*, vol. 48, no. 3, pp. 815-839, 2011. https://doi.org/10.1007/s13524-011-0040-5.
[45] J. J. Azose, H. Sevcikova, and A. E. Raftery, "Probabilistic population projections with migration uncertainty," *Proceedings of the National Academy of Sciences*, vol. 113, no. 23, pp. 6460-6465, 2016. https://doi.org/10.1073/pnas.1606119113.
[46] Ministry of National Development Planning/Bappenas, "Government strengthens regulation to address the transition toward an ageing society," Development News, Jul. 1, 2026.
[47] World Health Organization, Integrated Care for Older People (ICOPE): Guidance for Person-Centred Assessment and Pathways in Primary Care. Geneva, Switzerland: WHO, 2019.
[48] Ministry of National Development Planning/Bappenas, "Bappenas strengthens the National Ageing Strategy through community-based integrated elderly services," Development News, Jun. 23, 2025.