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Breaking the Intergenerational Cycle of Stunting in Indonesia: A Life-Course and Policy Perspective

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Abstract. Stunting remains a persistent public health challenge in Indonesia, threatening the country's human capital development and long-term economic growth. Although national strategies have emphasized interventions during the first 1,000 days of life, evidence suggests that stunting is rooted in intergenerational and life-course factors that begin long before pregnancy. This article aims to analyze the intergenerational pathways of stunting in Indonesia using a life-course perspective and to assess the alignment of national policies with this framework. A narrative review and policy analysis were conducted using peer-reviewed literature published between 2010 and 2025, as well as key national policy documents related to stunting reduction. The findings indicate consistent evidence linking adolescent anemia, early pregnancy, maternal undernutrition, and low birth weight to increased risk of childhood stunting. Despite strong political commitment, policy implementation remains fragmented, with limited emphasis on preconception and adolescent health interventions. Current strategies tend to focus on downstream interventions rather than upstream prevention. Strengthening integrated, multisectoral policies targeting critical life stages—particularly adolescence and preconception—is essential to break the intergenerational cycle of stunting. A comprehensive life-course approach is crucial to accelerate sustainable stunting reduction and support Indonesia's vision for human capital development toward 2045.

Keywords: *stunting; life-course approach; intergenerational cycle; adolescent health; maternal nutrition; low birth weight; public health policy; Indonesia.*

Abstrak. Stunting masih menjadi tantangan kesehatan masyarakat yang persisten di Indonesia dan mengancam pembangunan sumber daya manusia serta pertumbuhan ekonomi jangka panjang. Meskipun strategi nasional telah menekankan intervensi pada 1.000 Hari Pertama Kehidupan, berbagai bukti menunjukkan bahwa stunting berakar pada faktor antargenerasi dan siklus kehidupan yang dimulai jauh sebelum kehamilan. Artikel ini bertujuan untuk menganalisis jalur antargenerasi stunting di Indonesia menggunakan perspektif life-course serta menilai keselarasan kebijakan nasional dengan kerangka tersebut. Penelitian ini menggunakan pendekatan narrative review dan analisis kebijakan berdasarkan literatur ilmiah yang dipublikasikan pada tahun 2010–2025 serta dokumen kebijakan nasional terkait percepatan penurunan stunting. Hasil kajian menunjukkan adanya hubungan yang konsisten antara anemia remaja, kehamilan usia dini, kekurangan gizi ibu, dan berat badan lahir rendah dengan peningkatan risiko stunting pada anak. Meskipun terdapat komitmen politik yang kuat, implementasi kebijakan masih terfragmentasi dan belum optimal dalam menekankan intervensi pada fase prakonsepsi dan kesehatan remaja. Strategi yang ada cenderung berfokus pada intervensi hilir dibandingkan pencegahan hulu. Penguatan kebijakan terintegrasi dan multisektoral yang menargetkan tahap kehidupan kritis—khususnya masa remaja dan prakonsepsi—menjadi kunci untuk memutus siklus antargenerasi stunting. Pendekatan life-course yang komprehensif diperlukan guna mempercepat penurunan stunting secara berkelanjutan dan mendukung visi pembangunan sumber daya manusia Indonesia menuju tahun 2045.

Kata kunci: *stunting; pendekatan siklus kehidupan; siklus antargenerasi; kesehatan remaja; gizi ibu; berat badan lahir rendah; kebijakan kesehatan masyarakat; Indonesia.*

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1. INTRODUCTION

Stunting remains one of the most persistent public health challenges globally and disproportionately affects low- and middle-income countries, including Indonesia. Defined as impaired linear growth resulting from chronic undernutrition, stunting reflects cumulative deprivation that begins in early life and may extend across generations (Victora et al., 2008). Beyond physical growth failure, stunting is associated with impaired cognitive development, lower educational attainment, reduced productivity in adulthood, and increased risk of non-communicable diseases (Black et al., 2013; Hoddinott et al., 2013). These long-term consequences position stunting not merely as a nutritional issue, but as a structural barrier to human capital development.

Globally, the determinants of stunting are multifactorial and interrelated. Immediate causes include inadequate dietary intake and recurrent infections, while underlying determinants encompass maternal nutrition, household food insecurity, sanitation, poverty, and limited access to health services (Black et al., 2013; Prendergast & Humphrey, 2014). A pooled analysis across multiple countries estimated that fetal growth restriction and preterm birth, suboptimal breastfeeding, and repeated childhood infections contribute substantially to the global burden of stunting (Danaei et al., 2016). These findings highlight that growth faltering does not begin at birth but is often rooted in maternal health and nutritional status before and during pregnancy.

Indonesia continues to face a substantial burden of stunting despite national commitments to accelerate its reduction. The country has implemented multisectoral strategies emphasizing the first 1,000 days of life (from conception to two years of age), recognizing this period as critical for growth and brain development. Evidence demonstrates that interventions during this window—such as maternal supplementation, promotion of exclusive breastfeeding, and complementary feeding programs—are effective in improving child growth outcomes (Bhutta et al., 2013). However, focusing solely on the 1,000 days framework may overlook earlier life stages that significantly shape maternal nutritional reserves and pregnancy outcomes.

The life-course approach in public health provides a broader analytical lens to understand how biological, social, and environmental exposures accumulate over time and across generations (Victora et al., 2008). In this perspective, adolescent health, maternal nutritional status, and socioeconomic conditions before conception are critical determinants of fetal growth and subsequent child development. Adolescent anemia and undernutrition, for example, increase the risk of low birth weight (LBW), which is strongly associated with stunting in early childhood (Danaei et al., 2016). This pathway illustrates the intergenerational cycle of undernutrition: undernourished girls are more likely to become undernourished

mothers who give birth to growth-restricted infants, perpetuating vulnerability across generations (Black et al., 2013).

Empirical evidence from Indonesia supports the importance of these upstream determinants. Analyses of national data indicate that maternal education, household wealth, sanitation access, and maternal nutritional status are significant predictors of child stunting (Beal et al., 2018; Rachmi et al., 2016). Socioeconomic disparities contribute to uneven progress across regions, suggesting that structural inequities continue to shape child growth outcomes. While programmatic efforts have intensified, fragmentation in implementation and varying local capacities remain challenges in achieving equitable reductions.

Despite growing recognition of stunting as a multidimensional problem, much of the existing literature and policy discourse in Indonesia focuses on risk factor identification or intervention coverage during pregnancy and early childhood. Fewer studies explicitly integrate a life-course framework with policy analysis to examine whether national strategies adequately address critical stages such as adolescence and preconception. Given that improvements in early childhood nutrition alone may not fully disrupt the entrenched cycle of undernutrition, a broader conceptual and policy shift is warranted. Therefore, this article seeks to examine stunting in Indonesia through a life-course and intergenerational lens while assessing the alignment of national policies with this framework. By synthesizing empirical evidence and policy documents, this study aims to contribute a conceptual and strategic perspective for breaking the intergenerational cycle of stunting and strengthening sustainable human capital development toward Indonesia 2045.

2. LITERATURE REVIEW

2.1 The Life-Course Approach and Intergenerational Transmission of Undernutrition

The life-course approach in public health emphasizes that health outcomes are shaped by cumulative biological, social, and environmental exposures across different stages of life, including preconception, pregnancy, infancy, childhood, adolescence, and adulthood (Ben-Shlomo & Kuh, 2002). This framework posits that critical and sensitive periods exist during which exposures can have long-lasting or even permanent effects on health trajectories. In the context of stunting, early-life nutritional deprivation does not occur in isolation but reflects accumulated risks that begin before conception and may extend across generations.

Intergenerational transmission of undernutrition has been widely documented in low- and middle-income countries. Maternal height, often a proxy for a woman's childhood nutritional status, is strongly associated with child stunting and poor birth outcomes, suggesting that maternal growth failure can perpetuate risk in offspring (Ozaltin et al., 2010). Similarly, maternal underweight and micronutrient deficiencies before and during pregnancy contribute to intrauterine growth restriction and low birth weight (LBW), both of which increase the

likelihood of stunting in early childhood (Christian et al., 2013). These findings underscore that breaking the cycle of stunting requires interventions that extend beyond infancy and address maternal health long before pregnancy occurs.

Furthermore, life-course epidemiology highlights the concept of “accumulation of risk,” whereby repeated exposure to adverse socioeconomic and environmental conditions amplifies vulnerability (Halfon & Hochstein, 2002). In resource-constrained settings, poverty, limited education, inadequate sanitation, and food insecurity interact across generations, reinforcing structural inequities that sustain chronic undernutrition. Thus, a life-course perspective provides a comprehensive framework to understand stunting not merely as a childhood nutritional disorder but as a manifestation of long-term social disadvantage.

2.2 Biological and Social Pathways Linking Adolescence, Maternal Health, and Stunting

Adolescence represents a critical transitional period with significant implications for future maternal and child health. During adolescence, rapid physical growth increases nutritional requirements, and deficiencies during this stage may compromise adult stature and reproductive health (Patton et al., 2016). In many low- and middle-income settings, including Indonesia, adolescent girls face a double burden of malnutrition—undernutrition and micronutrient deficiencies—which heightens the risk of adverse pregnancy outcomes later in life.

Early marriage and adolescent pregnancy further compound these risks. Biological immaturity, combined with inadequate maternal nutritional reserves, increases the likelihood of preterm birth and low birth weight (Neal et al., 2012). LBW has consistently been identified as a strong predictor of stunting, particularly in the first two years of life (Rahman et al., 2016). Moreover, inadequate maternal dietary diversity and micronutrient intake during pregnancy contribute to suboptimal fetal growth, reinforcing the biological pathway linking maternal nutrition to child linear growth (Keats et al., 2018).

Beyond biological mechanisms, social determinants play a critical role in shaping these pathways. Maternal education has been repeatedly associated with improved child growth outcomes, likely mediated through enhanced health literacy, care-seeking behavior, and household resource allocation (Smith & Haddad, 2015). Household sanitation and access to clean water also influence child growth by reducing exposure to environmental enteric dysfunction and recurrent infections (Humphrey, 2009). Therefore, the interaction between biological vulnerability and structural determinants forms a complex web of causation that sustains the intergenerational cycle of stunting.

2.3 Policy and Multisectoral Approaches to Breaking the Cycle

7 Given the multidimensional nature of stunting, global consensus increasingly supports multisectoral strategies integrating nutrition-specific and nutrition-sensitive interventions (Ruel & Alderman, 2013). Nutrition-specific interventions address immediate determinants, such as micronutrient supplementation and breastfeeding promotion, whereas nutrition-sensitive strategies target underlying drivers, including food security, education, water and sanitation, and social protection systems.

9 Evidence suggests that isolated interventions may yield limited impact unless embedded within broader systemic reforms (Bhutta et al., 2008). For instance, improvements in women's empowerment, education, and economic participation have demonstrated positive associations with child nutritional outcomes across multiple countries (Cunningham et al., 2015). These findings highlight the importance of gender-responsive policies in addressing structural inequities that perpetuate undernutrition.

In Indonesia, decentralization presents both opportunities and challenges for multisectoral coordination. Effective implementation requires alignment between national priorities and local capacities, as well as robust monitoring and evaluation systems (Gillespie et al., 2013). Strengthening governance mechanisms, accountability frameworks, and cross-sector collaboration is therefore critical to operationalizing a life-course approach in policy practice. Without systemic integration that bridges adolescence, preconception care, maternal health, and early childhood interventions, efforts to reduce stunting risk remaining fragmented and insufficient to disrupt the intergenerational cycle.

2.4 National Policy Framework for Stunting Reduction in Indonesia

11 Indonesia has demonstrated strong political commitment to reducing stunting through a series of national strategies that emphasize multisectoral coordination and convergence. The issuance of Presidential Regulation No. 72/2021 on the Acceleration of Stunting Reduction marked a significant milestone in institutionalizing a whole-of-government approach, integrating health, nutrition, sanitation, education, and social protection sectors (TNP2K, 2018). This convergence framework aligns with global recommendations advocating coordinated action across sectors to address the multifactorial determinants of undernutrition (World Health Organization [WHO], 2014).

33 The national strategy prioritizes the first 1,000 days of life (1,000 HPK), reflecting evidence that interventions during pregnancy and early childhood yield high returns for growth and cognitive development (Shekar et al., 2017). However, evaluations of large-scale nutrition programs in decentralized systems suggest that implementation effectiveness depends heavily on local governance capacity, fiscal allocation, and accountability

mechanisms (Rokx et al., 2010). In Indonesia's decentralized health system, disparities in district-level capacity may lead to uneven program delivery and outcomes.

10 The integration of nutrition-specific and nutrition-sensitive interventions remains central to the national framework. Nutrition-specific programs include iron-folic acid supplementation, growth monitoring, and complementary feeding promotion, while nutrition-sensitive initiatives encompass sanitation improvements, poverty alleviation, and conditional cash transfers such as the Program Keluarga Harapan (PKH). Evidence from social protection programs indicates that conditional cash transfers can positively influence child nutritional outcomes when combined with health service utilization incentives (Fink et al., 2017). Nonetheless, the extent to which these programs systematically incorporate preconception and adolescent health components remains limited.

Furthermore, governance analyses highlight that effective multisectoral action requires clear role delineation, shared indicators, and coordinated monitoring systems (Gillespie et al., 2013). Although Indonesia has adopted convergence indicators to track district performance, fragmentation in data systems and variation in intersectoral collaboration continue to present operational challenges. Strengthening accountability frameworks and embedding life-course indicators—particularly those targeting adolescent nutrition and preconception health—could enhance policy coherence and long-term impact.

2.5 Gaps and Strategic Directions: Integrating a Life-Course Policy Perspective

Despite progress in policy commitment, several gaps remain in aligning national strategies with a comprehensive life-course framework. First, while adolescent anemia prevalence remains substantial in many regions, preventive interventions targeting girls before pregnancy often lack sustained coverage and behavioral reinforcement mechanisms (Kassebaum et al., 2014). Global evidence indicates that iron supplementation programs are more effective when integrated with school-based health services and broader empowerment initiatives (Salam et al., 2016). Thus, adolescent health should be positioned as a strategic entry point in stunting prevention.

4 Second, preconception care—defined as biomedical, behavioral, and social interventions before pregnancy—has not been fully institutionalized within routine primary healthcare systems in many low- and middle-income countries (Dean et al., 2014). Systematic reviews demonstrate that optimizing women's nutritional status before conception significantly reduces risks of adverse birth outcomes associated with subsequent stunting (Imdad & Bhutta, 2012). Expanding preconception screening and counseling within community health platforms could therefore strengthen upstream prevention.

Third, structural determinants such as gender inequality, limited female education, and economic vulnerability continue to mediate intergenerational risk transmission. Cross-national analyses reveal that improvements in women's status and decision-making autonomy are associated with reductions in child undernutrition (Carlson et al., 2015). Addressing these broader determinants requires policy integration beyond the health sector, including education reform and economic empowerment programs.

Finally, monitoring and evaluation systems often focus on short-term coverage indicators rather than long-term intergenerational outcomes. Implementation research underscores the importance of adaptive learning systems that enable policy refinement based on local evidence (Menon et al., 2018). Embedding life-course metrics—such as adolescent anemia prevalence, preconception BMI screening, and maternal height trends—into national dashboards could provide more robust indicators of upstream progress. In summary, while Indonesia's stunting reduction framework reflects strong political will and convergence principles, the integration of a life-course policy perspective remains incomplete. Strengthening adolescent and preconception interventions, enhancing multisectoral accountability, and aligning monitoring systems with intergenerational indicators are critical steps toward sustainably breaking the cycle of stunting.

3. METHOD

3.1 Study Design

This study employed a narrative review combined with policy analysis to examine the intergenerational determinants of stunting in Indonesia through a life-course perspective. A narrative review approach was selected to allow conceptual integration of diverse empirical findings and theoretical frameworks, particularly when addressing complex, multisectoral public health issues (Green et al., 2006). In addition, a policy analysis component was incorporated to assess the alignment between scientific evidence and national stunting reduction strategies using a structured analytical lens (Walt & Gilson, 1994).

3.2 Data Sources and Search Strategy

A comprehensive literature search was conducted using electronic databases including PubMed, Scopus, Web of Science, and Google Scholar for articles published between 2010 and 2025. Search terms included combinations of: "stunting," "intergenerational," "life-course," "adolescent nutrition," "maternal health," "low birth weight," "preconception care," "Indonesia," and "nutrition policy." In addition to peer-reviewed literature, national policy documents were retrieved from official government and institutional websites, including ministries related to health, development planning, and social protection. Reference lists of relevant articles were also screened to identify additional sources. The search strategy was iterative to ensure thematic saturation and conceptual depth.

3.3 Inclusion and Exclusion Criteria

Studies were included if they:

1. Examined determinants of stunting within a life-course or intergenerational framework;
2. Focused on maternal, adolescent, or preconception factors;
3. Addressed policy or multisectoral interventions related to stunting;
4. Were published in English or Bahasa Indonesia between 2010 and 2025.

Editorials without analytical content and studies unrelated to child linear growth were excluded. The selection process followed principles of transparency and structured synthesis commonly recommended in evidence reviews (Grant & Booth, 2009).

3.4 Data Extraction and Analytical Framework

Relevant information from selected articles and policy documents was extracted into a standardized matrix including: study design, population, key determinants identified, policy implications, and stage of the life-course addressed. Findings were then synthesized thematically according to life stages (adolescence, preconception, pregnancy, early childhood). For policy analysis, the policy triangle framework—which examines policy content, context, actors, and processes—was applied to evaluate how Indonesia’s national stunting strategy integrates life-course determinants (Walt & Gilson, 1994). This dual analytical approach enabled triangulation between empirical evidence and policy direction, enhancing interpretative rigor in understanding systemic gaps and opportunities for strengthening intergenerational prevention.

4. RESULT

4.1 Evidence of Intergenerational Transmission Across the Life-Course

The synthesis of empirical literature demonstrates consistent evidence that stunting in Indonesia reflects an intergenerational accumulation of biological and social risks. Maternal short stature—an indicator of childhood undernutrition—has been strongly associated with increased risk of stunting among offspring in multiple low- and middle-income settings (Addo et al., 2013). This finding supports the hypothesis that linear growth failure is transmitted across generations through both biological and socioeconomic pathways.

Adolescent nutritional status emerged as a critical upstream determinant. Iron deficiency anemia and inadequate dietary intake during adolescence compromise growth and future reproductive health, increasing the likelihood of adverse birth outcomes (Stevens et al., 2022). Early marriage and adolescent pregnancy further elevate risks due to biological immaturity and insufficient maternal nutrient reserves (Fall et al., 2015). These pathways significantly contribute to low birth weight (LBW), a well-established predictor of stunting in early childhood (Aryastami et al., 2017).

Additionally, intrauterine growth restriction and poor maternal weight gain during pregnancy were repeatedly linked to postnatal growth faltering (Ota et al., 2014). The evidence suggests that fetal growth impairment not only increases immediate neonatal vulnerability but also predisposes children to chronic undernutrition during infancy. These biological findings confirm that stunting often originates before birth and reflects maternal health status shaped years earlier.

4.2 Socioeconomic and Environmental Risk Accumulation

Beyond biological determinants, socioeconomic inequalities play a pivotal role in sustaining intergenerational risk. Secondary analyses of national demographic surveys show that children from the lowest wealth quintiles face significantly higher odds of stunting compared to those from wealthier households (Titaley et al., 2019). Maternal education consistently demonstrates a protective effect, likely mediated through improved health literacy, infant feeding practices, and healthcare utilization (Arsyad et al., 2022).

Environmental determinants, particularly water, sanitation, and hygiene (WASH), were also identified as critical contributors. Poor sanitation increases exposure to enteric pathogens, leading to environmental enteric dysfunction, chronic inflammation, and impaired nutrient absorption (Pickering et al., 2019). Cluster-randomized trials in low-income settings indicate that sanitation improvements alone may not fully eliminate stunting but are necessary components of integrated interventions (Null et al., 2018). These findings reinforce the need for multisectoral action beyond nutrition-specific programs.

Food insecurity and limited dietary diversity further compound vulnerability. Studies examining dietary patterns in Indonesian households highlight inadequate consumption of animal-source foods and micronutrient-rich diets among children in rural and low-income settings (Headey et al., 2018). Such dietary limitations interact with infection burden and maternal undernutrition, reinforcing the cyclical nature of growth failure.

4.3 Gaps Across Life Stages in Policy Implementation

The review identified important discrepancies between life-course risk factors and the current policy emphasis. While Indonesia's national strategy strongly prioritizes the first 1,000 days of life, evidence suggests that interventions targeting adolescence and preconception remain comparatively underdeveloped (Bappenas, 2020). School-based iron supplementation programs exist, yet coverage and adherence remain inconsistent, particularly in rural areas (Harjatmo et al., 2021).

Preconception care services are not uniformly integrated into primary healthcare delivery. Research indicates that many women enter pregnancy with undiagnosed anemia or chronic energy deficiency, limiting the effectiveness of antenatal interventions (Young et al., 2019). Moreover, decentralization has resulted in variation in district-level program

implementation and monitoring capacity, creating disparities in service quality and outreach (McGovern et al., 2017).

Monitoring systems predominantly focus on child growth indicators rather than upstream determinants such as adolescent anemia prevalence or maternal preconception BMI. This limits the ability to assess long-term intergenerational progress. Implementation studies highlight the importance of aligning local accountability structures with national convergence indicators to improve policy coherence (Ahmed et al., 2020).

4.4 Proposed Integrated Life-Course Model

Synthesizing the findings, an integrated life-course model emerges linking:

- (1) Adolescent anemia and undernutrition →
- (2) Early pregnancy and inadequate maternal nutritional reserves →
- (3) Low birth weight and intrauterine growth restriction →
- (4) Recurrent infections and inadequate complementary feeding →
- (5) Childhood stunting →
- (6) Reduced educational attainment and adult productivity →
- (7) Socioeconomic disadvantage in the next generation.

This cyclical model aligns with global epidemiological evidence emphasizing cumulative disadvantage and biological embedding (Lu et al., 2016). Breaking this cycle requires synchronized interventions at each critical stage rather than isolated focus on infancy alone. Overall, the results demonstrate that while Indonesia has made notable policy commitments, empirical evidence supports expanding the scope of intervention toward adolescence and preconception periods. Addressing upstream determinants is essential to achieving sustainable reductions in stunting prevalence and advancing human capital development.

5. DISCUSSION

5.1 Interpretation of Findings Within a Life-Course Framework

The findings of this review reinforce the understanding that stunting in Indonesia is not solely a manifestation of inadequate infant feeding practices but rather the cumulative result of biological, social, and structural exposures operating across the life-course. The intergenerational association between maternal undernutrition, fetal growth restriction, and subsequent child stunting reflects biological embedding of disadvantage (Barker, 2004). The developmental origins of health and disease (DOHaD) hypothesis provides a useful explanatory model, suggesting that nutritional deprivation during critical periods of fetal development programs long-term growth trajectories and metabolic outcomes (Gluckman et al., 2008).

Moreover, the persistence of socioeconomic gradients in stunting prevalence indicates that growth faltering is deeply intertwined with poverty and social inequity. Global comparative

analyses demonstrate that reductions in stunting are strongly associated with improvements in maternal education, sanitation, and household income, rather than health-sector interventions alone (Headey & Hoddinott, 2015). These findings align with our results, which highlight that biological risk pathways are amplified by structural determinants operating across generations.

5.2 Why Current Strategies Remain Insufficient

Indonesia's strong policy commitment and multisectoral convergence strategy represent substantial progress. However, the evidence suggests that interventions remain disproportionately concentrated in the first 1,000 days of life, with insufficient institutionalization of upstream measures targeting adolescents and preconception women. While the 1,000-day framework is supported by robust evidence (Victora et al., 2021), relying exclusively on this window may fail to address maternal growth deficits established years earlier.

Comparative analyses from other low- and middle-income countries indicate that countries achieving accelerated stunting reduction combined direct nutrition interventions with broader social policy reforms, including female education expansion and poverty reduction strategies (Shekar et al., 2021). In Indonesia, decentralization has created heterogeneity in program quality and implementation fidelity. Implementation science literature emphasizes that policy effectiveness depends not only on design but also on local capacity, governance accountability, and adaptive learning mechanisms (Peters et al., 2013). Without strengthening district-level systems and cross-sector accountability, national convergence efforts may yield uneven results.

5.3 Strengthening Upstream Interventions: Adolescence and Preconception

The discussion of adolescent and preconception health is particularly critical. Globally, maternal height and adolescent nutritional status are powerful predictors of child linear growth (Addo et al., 2013). Therefore, interventions during adolescence—such as school-based iron supplementation, reproductive health education, and empowerment programs—should be strategically integrated within stunting reduction frameworks. Evidence from integrated adolescent health initiatives suggests that combining nutrition with reproductive health and social empowerment interventions yields synergistic benefits (Patton et al., 2016).

Preconception care also remains an underutilized entry point. The World Health Organization emphasizes that optimizing women's health before conception can substantially reduce adverse pregnancy outcomes (WHO, 2013). Expanding routine screening for anemia and chronic energy deficiency in community health settings could help address risks before pregnancy occurs. Importantly, these upstream interventions should be embedded within gender-responsive policies that enhance women's autonomy and access to education, as gender inequity remains a structural determinant of child undernutrition (Malapit et al., 2015).

5.4 Multisectoral Governance and Policy Implications

Breaking the intergenerational cycle of stunting requires more than expanding service coverage; it necessitates systemic integration across sectors. Evidence from multisectoral nutrition case studies indicates that sustained reductions in undernutrition are associated with strong political leadership, clear coordination mechanisms, and consistent financing (Nisbett et al., 2014). In Indonesia, strengthening data integration across ministries and aligning local performance indicators with life-course metrics could improve accountability.

Furthermore, social protection programs—when nutrition-sensitive and well-targeted—can mitigate poverty-related risk accumulation (Ruel et al., 2018). Aligning cash transfer programs with adolescent health services and maternal nutrition monitoring could enhance their impact. Monitoring systems should evolve beyond child anthropometric indicators to include upstream indicators such as adolescent anemia prevalence, maternal preconception BMI, and age at first pregnancy.

8 This review underscores the need for longitudinal and implementation research to better understand how life-course interventions interact within decentralized systems. Strengthening routine data systems and evaluating cost-effectiveness of upstream interventions will be crucial to guide resource allocation. Future research should explore district-level variations in convergence implementation and identify scalable models that effectively integrate adolescent, preconception, and maternal health services.

This study relies on secondary literature and policy documents, which may not fully capture district-level heterogeneity or recent program adjustments. As a narrative review, the synthesis prioritizes conceptual integration rather than quantitative meta-analysis. Nonetheless, the triangulation of empirical evidence and policy analysis provides a comprehensive perspective on systemic gaps and opportunities.

6. CONCLUSION

Stunting in Indonesia represents a complex and deeply rooted public health challenge that extends beyond early childhood and reflects cumulative biological and socioeconomic disadvantages across generations. This review demonstrates that the intergenerational cycle of stunting begins long before birth, shaped by adolescent nutritional status, maternal health, socioeconomic inequality, and structural determinants such as education, sanitation, and poverty. While Indonesia has made substantial progress through multisectoral convergence strategies and strong political commitment, current interventions remain disproportionately concentrated within the first 1,000 days of life.

35 A life-course perspective reveals that sustainable reductions in stunting require upstream investment in adolescent health, preconception care, and women's empowerment. Addressing anemia in adolescent girls, delaying early marriage and pregnancy, improving

maternal nutritional reserves before conception, and strengthening social protection mechanisms are critical to interrupting biological and social transmission of risk. Without systematic integration of these upstream determinants into policy design, monitoring systems, and accountability frameworks, progress may remain incremental and uneven across regions.

Breaking the intergenerational cycle of stunting demands coordinated governance, strengthened district-level implementation capacity, and alignment between nutrition-specific and nutrition-sensitive policies. Expanding monitoring indicators to include adolescent and preconception metrics can provide a more comprehensive measure of long-term progress. Ultimately, accelerating stunting reduction in Indonesia requires a **paradigm shift**—from focusing primarily on child survival to investing in intergenerational human capital development. Embedding a comprehensive life-course approach within national and subnational policies is essential to achieving sustainable improvements in child growth and advancing Indonesia's vision for equitable human development toward 2045.

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