

Original Article

Childhood Stunting in East Java: A Health System Structural Analysis Using Generalized Structural Equation Modeling

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ABSTRAK

Despite decades of investment in health service infrastructure and social protection programs, the pathways through which service utilization, insurance coverage, and poverty jointly shape stunting risk among children under five in East Java remain poorly understood at the structural level. This study analyzed data from the Indonesian Nutritional Status Survey (SSGI) 2024 among 20,304 children under five in East Java, employing Generalized Structural Equation Modeling (GSEM) to simultaneously estimate the direct, indirect, and total effects of health service utilization, insurance coverage, household poverty, and sociodemographic characteristics on stunting risk. GSEM findings demonstrated that lacking health insurance ($B = 0.273$; 95% CI: 0.194–0.352; $p < 0.001$) and household poverty ($B = 0.137$; 95% CI: 0.107–0.167; $p < 0.001$) exerted significant direct effects on stunting, while health service utilization frequency ($B = 0.037$; 95% CI: –0.067 to 0.141; $p = 0.489$) and service type diversity ($B = -0.001$; 95% CI: –0.102 to 0.099; $p = 0.987$) showed no significant direct effects, suggesting that service contact alone is insufficient without accompanying improvements in care quality. Child age emerged as a strong cumulative predictor of stunting, and household poverty operated through both direct and indirect pathways mediated by insurance status and service utilization. These results indicate that stunting reduction in East Java demands simultaneous action on service quality, insurance coverage equity, and upstream poverty alleviation.

INTRODUCTION

Stunting in children under five signals more than poor nutrition. It reflects years of unmet needs across households, health systems, and social protections during the most critical window of a child's development. Globally, 148 million children remained stunted as of 2024, with prevalence falling only modestly from 26.4% in 2012 to 23.2% today (UNICEF, 2025). Indonesia has made measurable progress, with national stunting prevalence dropping from 27.7% in 2019 to 19.8% in 2024 based on the Survei Status Gizi Indonesia (SSGI) (Ministry of Health RI, 2025a), yet reaching the 2029 target of 14.2% demands a reduction of 7.3 percentage points in five years, faster than any previous pace (Ministry of the State Secretariat RI, 2025). Achieving this trajectory requires more than scaling up existing interventions. A formative evaluation of Indonesia's National Strategy to Accelerate Stunting Prevention found that the country's nutritional challenge extends beyond stunting prevalence alone, with undernutrition coexisting alongside rising overweight and micronutrient deficiencies in what has been described as a triple burden of malnutrition. The evaluation further documented that multisectoral coordination failures, fragmented financing mechanisms, and weak integration of health services at the sub-national level have collectively constrained progress, pointing to systemic barriers that aggregate prevalence figures cannot capture (UNICEF, 2024).

Despite recording one of the steepest provincial declines in stunting prevalence nationally, East Java continues to carry one of the largest absolute burdens of child stunting in Indonesia. Stunting prevalence in the province fell from 19.2% in 2022 to 14.7% in 2024, placing it second-lowest nationally, yet 430,780 children remain stunted, the third highest absolute count in the country (Ministry of Health RI, 2025a). Nationally, half of all stunted children are concentrated in just six provinces, with East Java among them; projections suggest that a ten percent reduction across these six provinces alone would translate into a four to five percent decline in national prevalence, underscoring the outsized policy leverage that provincial-level progress in East Java carries for Indonesia's overall stunting trajectory (Ministry of Health RI, 2025b).

Higher coverage of maternal and child health services, including antenatal care, delivery at health facilities, and growth monitoring, was consistently inversely associated with stunting prevalence across Indonesian provinces (Simbolon, Adevianti, Setianingsih, Ningsih, & Andriani, 2021), and children in areas without access to primary healthcare facilities were 1.27 times more likely to experience stunting (Apriliani, 2025). Yet health insurance ownership alone showed no significant protective effect against stunting without concurrent improvements in service quality and utilization (Apriliani, 2025); subsidized JKN members remained significantly less likely to use hospital and specialized services compared to contributing members (Cheng et al., 2025), and revised enrollment procedures have introduced waiting periods that limit active coverage for pregnant women through the critical period of pregnancy and delivery (UNICEF, 2024). Among low-income families, non-utilization of antenatal care increased the odds of stunting by 1.49 times, suggesting that within poor households the failure to engage with health services substantially elevates child growth risk (Wulandari et al., 2025), while social protection programs including the Family Welfare Card and government assistance transfers rely on general poverty proxies rather than stunting-specific targeting criteria, further attenuating their protective effect for the most nutritionally vulnerable households (UNICEF, 2024). Place of residence was identified as one of four significant determinants of stunting among children under five in East Java, with toddlers in rural areas facing a higher risk than their urban counterparts (Laksono & Megatsari, 2020). These structural conditions, in which insurance ownership does not guarantee service access and poverty programs do not systematically reach stunted children, point to the need for a health system analytical approach that models the pathways between poverty, insurance, and service utilization simultaneously.

Existing studies on stunting in East Java have either used district-level ecological approaches or examined individual determinants without modeling their structural interrelationships, leaving the simultaneous pathways linking poverty, insurance, and health service utilization to stunting unmapped at the provincial level. National evaluations have explicitly called for structural evidence to guide sub-national health system reform in priority provinces (UNICEF, 2024), yet no study has applied Generalized Structural Equation Modeling (GSEM) to answer this call using SSGI 2024 data in East Java. This study fills that gap, applying GSEM to produce structural evidence specific enough to guide regional health system policy in East Java.

LITERATURE REVIEW

Stunting in the Context of Health Systems

Stunting is a multifactorial condition rooted in the complex interplay of immediate, underlying, and enabling determinants, as detailed in the UNICEF Conceptual Framework on the Determinants of Maternal and Child Nutrition (UNICEF, 2021). The immediate determinants are defined by the reciprocal relationship between diets and care practices. At the underlying level, nutritional outcomes are shaped by the availability of food, caregiving practices, and essential services, including health, sanitation, and education, that are accessible to children and women within their households and environments. These factors are further sustained by enabling determinants, which encompass the broader political, financial, and social conditions necessary to uphold nutritional rights (UNICEF, 2021). Within the Indonesian health system, these structural pathways are operationalized through the 8 Key Convergence Actions, a vital management framework requiring local governments to align multisectoral efforts. This framework functions as a comprehensive management cycle at the sub-national level, encompassing: (1) situation analysis to identify service gaps; (2) activity planning; (3) consultative meetings (Rembuk Stunting) to secure political commitment; (4) the issuance of regional regulations to empower village roles; (5) the mobilization of human development workers; (6) the enhancement of data management systems; (7) the publication of children's growth measurement results; and (8) the conduct of annual performance reviews. This integration mechanism is designed to ensure that both nutrition-specific and nutrition-sensitive services effectively converge upon priority households, particularly during the critical first 1,000 days of life (UNICEF, 2024).

Health Service Utilization, Service Diversity, Insurance, and Stunting

The backbone of stunting prevention within the Indonesian health system is the utilization of primary healthcare services, primarily delivered through Community Health Centres (Puskesmas) and Integrated Health Posts (Posyandu) (Apriliani, 2025; UNICEF, 2024). These facilities serve as the frontline for both curative and preventive care, providing essential nutrition-specific interventions such as antenatal care (ANC), complete basic immunization, and routine growth monitoring (Ministry of Health RI, 2024). Evidence indicates that geographical accessibility is a critical determinant of success; for instance, children residing in areas without adequate access to a Puskesmas face a higher risk of experiencing stunting (Apriliani, 2025). In East Java, previous study shows that residence in rural areas significantly increases this risk due to disparities in infrastructure and access to health services compared to urban centers (Laksono & Megatsari, 2020). Diverse service indicators are used to measure the effectiveness of these interventions. High-quality ANC, which now mandates at least six visits during pregnancy, is strongly associated with reduced stunting prevalence by ensuring maternal nutrition and identifying risk factors early (UNICEF, 2024). Similarly, complete basic immunization acts as a protective factor, as children without complete immunization history have been found to have a significantly higher risk of linear growth disorders (Simbolon et al., 2021). Monthly growth monitoring at Posyandu, allows for the early detection of growth faltering. However, the efficacy of these services is often mediated by the capacity of health cadres and the consistency of parental attendance, which remains a persistent challenge in many regions (UNICEF, 2024). The National Health Insurance (JKN) scheme acts as a crucial enabling factor by alleviating financial barriers to seeking care. Despite its role in providing financial protection, the impact of JKN on child nutritional outcomes is complex and characterized by structural disparities (Cheng et al., 2025). Consequently, research underscores that health insurance ownership alone is insufficient for stunting reduction unless it is accompanied by concurrent improvements in service quality and maternal health literacy.

Poverty as a Structural Determinant of Stunting

Household poverty sits at the base of the UNICEF causal hierarchy as a fundamental driver of stunting, operating through multiple simultaneous pathways, including food insecurity, constrained healthcare access, poor sanitation, and inadequate living conditions (UNICEF, 2021). In low-income Indonesian families, poverty has been identified as one of the strongest and most consistent predictors of stunting, with its effects mediated through reduced healthcare utilization, lower insurance uptake, and limited dietary diversity (Arief et al., 2025; Wulandari et al., 2025). Treating poverty as a latent construct, measured through observable indicators of social welfare program participation, allows its pervasive influence to be modeled simultaneously across multiple downstream pathways, capturing the full structural weight of economic deprivation on child nutritional outcomes.

METHOD

Study Design and Data Source

This study used a cross-sectional design with secondary data from the 2024 Survei Status Gizi Indonesia (SSGI), a nationally representative nutritional status survey conducted by the Ministry of Health of the Republic of Indonesia. The SSGI 2024 used two stages one phase stratified sampling (Ministry of Health RI, 2025a), producing valid estimates at the provincial level. This analysis was restricted to the East Java province subset. The SSGI 2024 received ethical approval from the Health Research Ethics Committee (Komisi Etik Penelitian Kesehatan/KEPK) of Poltekkes Kemenkes Jakarta II (approval number: DP.04.03/I/KE/230/2024). As this study involved analysis of existing de-identified secondary data, no additional ethical approval was required. Data confidentiality was further ensured through the executed NDA (NDA Number: 2602EDF1EB103813) with BKPK Kemenkes RI.

Study Population

The study population comprised all children aged 0 to 59 months in East Java captured in the SSGI 2024 sampling frame. Children were included if they resided in East Java and had complete data on height-for-age measurements and all study variables. Children with missing values on any variable were excluded. The final analytical sample comprised 20,304 children.

Variables

Dependent Variable

The dependent variable was childhood stunting, defined as a height-for-age z-score below minus two standard deviations from the WHO Child Growth Standards median (WHO, 2015), coded as 1 for stunted and 0 for not stunted.

Independent Variables

Four variables were specified as primary structural determinants in the GSEM model. Health service utilization (HSU) was operationalized as a composite indicator of healthcare visit frequency over the past 12 months, comprising nine service components: weight measurement, height measurement, mid-upper arm circumference measurement, developmental monitoring, nutrition counseling, vitamin A supplementation, deworming medication, treatment during child illness, and protein education. The number of health service types utilized (type_serv) was operationalized as a composite indicator of service diversity, capturing the breadth of distinct service types accessed by the child or household across the same nine service domains, scored by the count of unique service types received rather than visit frequency. Health insurance ownership (insurance) was a binary variable indicating insurance membership at the household level. Household poverty was treated as a latent variable, measured through two manifest indicators, namely ownership of a Family Welfare Card (p_1) and receipt of government assistance programs in the past 12 months (p_2), both drawn from household-level SSGI 2024 data.

Covariates

Age group was included to control for developmental differences in stunting risk and health service engagement across the 0 to 59 month range. Place of residence (urban or rural) was included as a structural covariate to account for differences in health infrastructure, service accessibility, and social protection reach across residential settings.

Statistical Analysis

Data were analysed using Stata version 19. Descriptive statistics characterised the study population, including stunting prevalence and distributions of all study variables. The primary analysis employed Generalized Structural Equation Modeling (GSEM) to simultaneously estimate direct and indirect structural pathways among stunting determinants. All analyses incorporated the SSGI 2024 complex survey design, including sampling weights, stratification, and clustering, restricted to East Java province to ensure valid provincial-level inference.

RESULT AND DISCUSSION

To examine the structural determinants of stunting among children under five in East Java, this section presents univariate characteristics of the study sample followed by a GSEM analysis of the direct, indirect, and total pathways linking health service utilization, insurance, and household poverty to stunting risk.

Univariate Analysis

The study sample comprised 20,304 children under five in East Java Province based on SSGI 2024 data. The prevalence of stunting was 15.55%, meaning approximately one in six children was classified as stunted based on height-for-age z-score categorization. Regarding health service utilization, the majority of children (67.86%) were in the high utilization category, while the remaining 32.14% were in the low utilization category. In terms of service type diversity, 63.04% of households accessed many types of health services, whereas 36.96% accessed only a few. Health insurance coverage was relatively high, with 61.03% of children belonging to households with active insurance membership. With respect to household poverty indicators, only 13.02% of households owned a Family Welfare Card, while more than half (56.99%) had received at least one government assistance program in the past 12 months. In terms of child age distribution, the majority of children fell in the 24–59.99 month age group (65.10%), followed by the 6–23.99 month group (29.60%), with infants aged 0–5.99 months comprising the smallest proportion (5.31%). Finally, the sample was predominantly urban, with 71.17% residing in urban areas and 28.83% in rural areas.

Table 1. Univariate Analysis

Variable	Category	n	%
Stunting Status	Non-Stunted	17,146	84.45
	Stunted	3,158	15.55
Health Service Utilization (HSU)	High	13,779	67.86
	Low	6,525	32.14
Number of Service Types Utilized	Many	12,800	63.04
	Few	7,504	36.96
Health Insurance Ownership	Yes	12,392	61.03
	No	7,912	38.97
Family welfare Card Ownership (p_1)	No	17,660	86.98
	Yes	2,664	13.02
Receipt of Government Assistance (p_2)	No	8,733	43.01
	Yes	11,571	56.99
Child Age (months)	0 - 5.99	1,078	5.31
	6 - 23.99	6,009	29.60
	24 - 59.99	13,217	65.10
Residential Setting	Urban	14,450	71.17
	Rural	5,854	28.83

Measurement Model and Model Fit

The measurement model confirmed the construct validity of household poverty as a latent variable (Table 2). The factor loading of p_2 (receipt of government assistance) was 1.167 (95% CI: 0.961–1.374; $p < 0.001$), indicating that government assistance receipt was a strong and statistically reliable manifest indicator of the underlying poverty construct alongside the reference indicator p_1 (Family Welfare Card ownership). The overall model fit was characterised by a log-likelihood of $-68,295.38$, AIC of $136,628.8$, and BIC of $136,779.2$, which collectively support the parsimony and theoretical plausibility of the specified structural pathways in representing stunting determinants among children under five in East Java.

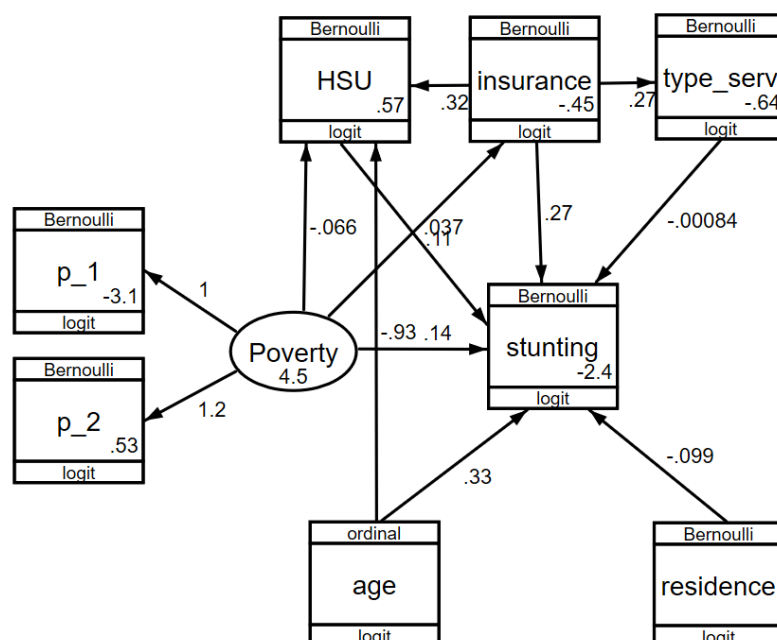


Figure 1. GSEM Model

Generalized Structural Equation Modeling (GSEM)

The East Java GSEM results (Figure 1; Table 2) revealed that health service utilization (HSU) did not demonstrate a statistically significant direct effect on stunting ($B = 0.037$; 95% CI: -0.067 to 0.141 ; $p = 0.489$). Similarly, service type

diversity (type_serv) showed no significant direct effect on stunting ($B = -0.001$; 95% CI: -0.102 to 0.099 ; $p = 0.987$). These null findings suggest that the frequency and diversity of health service use alone may not be sufficient to produce a measurable direct reduction in stunting risk within the East Java context. This should not, however, be interpreted as implying that health services are irrelevant. Simbolon et al. (2021), analyzing aggregate provincial data from the 2013 and 2018 Basic Health Research (Riskesdas) across 34 provinces, found that coverage of antenatal care, neonatal examination, complete immunization, growth monitoring, and health card ownership were all significantly and negatively correlated with stunting prevalence, demonstrating that services delivered with adequate coverage and quality do contribute meaningfully to stunting reduction at the population level (Simbolon et al., 2021). The critical distinction is therefore between the mere frequency of contact and the substantive quality of nutritionally relevant services, a nuance the null direct effect of HSU in this model captures precisely.

The Formative Evaluation of the National Strategy to Accelerate Stunting Prevention identified as a key structural challenge the lack of integration and standardization in service delivery at health facility and community levels, with considerable variation in service quality across districts and between public and private facilities. Staff at posyandu and puskesmas often do not communicate the rationale for nutrition-sensitive services to the public, suggesting that even when services are accessed their nutritional value may not be fully realized by beneficiaries (UNICEF, 2024). In East Java, the Regional Medium-Term Development Plan (RPJMD) 2025–2029 targets a reduction in stunting prevalence from 14.7% in 2024 to 12% by 2029 through the achievement of specific and sensitive intervention indicators. However, the document acknowledges that a key constraint is that follow-up interventions remain sub-optimal due to resource limitations, which hinders the overall achievement of healthy family outcomes at the household level (East Java Government, 2025).

Lacking health insurance demonstrated a significant positive direct effect on stunting ($B = 0.273$; 95% CI: 0.194 – 0.352 ; $p < 0.001$), indicating that children in uninsured households faced substantially higher stunting odds compared to those with active health insurance membership. With 38.97% of households lacking coverage, a non-trivial proportion of East Java's under-five population remains outside the health insurance protection system. This coverage gap carries meaningful consequences for service access, national evidence from Cheng et al. (2025) confirms that insurance status is a critical enabling factor for hospital utilization; specifically, uninsured individuals face significantly restricted access to both public and private hospital services compared to contributing JKN members, often due to perceived cost constraints (Cheng et al., 2025). Recognizing this, the the Regional Medium-Term Development Plan (RPJMD) 2025–2029 explicitly identifies JKN membership coverage as a key indicator of health quality, embedding universal health financing as a core pillar of the Jatim Sehat mission, consistent with the mandate under Law No. 17 of 2023 that the national health insurance program guarantee access to the full spectrum of promotive, preventive, curative, rehabilitative, and palliative care (Government RI, 2023). However, policy ambition alone has not eliminated enrollment barriers, the Formative Evaluation further identified bureaucratic barriers to JKN enrollment as a practical obstacle, noting that the process of issuing health insurance cards has become more complicated since December 2022, creating delays that leave vulnerable households without coverage during periods of greatest health need (UNICEF, 2024).

Household poverty exerted a significant direct effect on stunting ($B = 0.137$; 95% CI: 0.107 – 0.167 ; $p < 0.001$), confirming that children from economically deprived households faced substantially higher stunting likelihood (Table 2). Arief et al. (2025) demonstrated a clear wealth gradient in stunting risk using SKI 2023 data (Arief et al., 2025). Wulandari et al. (2025) provide further corroboration, among the two lowest wealth quintiles of Indonesian households using SSGI 2022 data, 19.0% of children under two experienced stunting, and non-utilization of antenatal care, a service access failure closely linked to economic deprivation, independently increased the odds of stunting by 1.49 times (Wulandari et al., 2025). A previous study using GSEM in Uganda demonstrated that stunting determinants operate through complex hierarchical pathways, where distal factors like household wealth significantly shape immediate outcomes such as birth size and breastfeeding practices (Maniragaba, Atuhaire, & Rutayisire, 2023). This is directly acknowledged under Law No. 17 of 2023, which assigns responsibility to central and regional governments for ensuring nutritional fulfillment among poor families (Government RI, 2023).

Child age was a significant predictor of stunting ($B = 0.330$; 95% CI: 0.257 – 0.403 ; $p < 0.001$), reflecting the accumulation of stunting risk across the first 1,000 days and into the toddler years, a pattern particularly concerning given that 65.10% of children in this sample were already aged 24 to 59.99 months and had thus passed the critical early intervention window. This association is consistent across multiple sources: Laksono and Megatsari (2020) found toddler age a significant determinant of stunting in East Java using 2017 data across 10,814 children, Wulandari et al. (2025) found children aged 12–23 months were 3.317 times more likely to be stunted than those aged 0–11 months using SSGI 2022 national data among low-income families, and Maniragaba et al. (2023) found children aged 6–47 months had significantly higher

undernutrition likelihood in resource-poor environments (Laksono & Megatsari, 2020; Wulandari et al., 2025; Maniragaba et al., 2023). Residential setting demonstrated a significant negative direct effect on stunting ($B = -0.099$; 95% CI: -0.185 to -0.012 ; $p = 0.025$), suggesting that children in rural East Java faced lower stunting odds after accounting for insurance, poverty, and service utilization pathways, a finding that contrasts with several studies (Arief et al., 2025; Laksono & Megatsari, 2020; Wulandari et al., 2025), all of whom found rural children at equal or greater stunting risk. The consistent contrasting direction across these three sources suggests that the negative residential effect in the current GSEM model may reflect compositional changes in East Java's urban-rural nutritional landscape by 2024, or contextual factors specific to the provincial structural model after simultaneously accounting for the other pathways, warranting further longitudinal investigation.

Table 2. Generalized Structural Equation Modeling Estimation

Dependent variables	Independent variables	B	95% CI	P value
Structural				
stunting	← HSU	0.037	-0.067 to 0.141	0.489
	← type_serv	-0.001	-0.102 to 0.099	0.987
	← insurance	0.273	0.194 to 0.352	<.001*
	← poverty	0.137	0.107 to 0.167	<.001*
	← age	0.330	0.257 to 0.403	<.001*
	← residence	-0.099	-0.185 to -0.012	0.025
HSU	← insurance	0.316	0.252 to 0.379	<.001*
	← age	-0.933	-0.984 to -0.882	<.001*
	← poverty	-0.066	-0.088 to -0.044	<.001*
type_serv	← insurance	0.274	0.216 to 0.332	<.001*
insurance	← poverty	0.108	0.083 to 0.133	<.001*
Measurement				
p_1	← Poverty	1 ^a		
p_2		1.167	0.961 to 1.374	<.001*
Type				
N observation	= 20,304			
df	= 19			
Log likelihood	= -68295.38			
AIC	= 136628.8			
BIC	= 136779.2			

HSU, Health Service Utilization; AIC, Akaike information criterion; BIC, Bayesian information criterion; CI, confidence interval; df, degrees of freedom.

*Significant at a level of 5%.

^a Coefficient fixed to 1 to set the scale of the latent variable

As presented in Figure 1 and Table 2, uninsured households showed significantly lower HSU ($B = 0.316$; 95% CI: 0.252 – 0.379 ; $p < 0.001$) and accessed a narrower range of service types ($B = 0.274$; 95% CI: 0.216 – 0.332 ; $p < 0.001$) compared to insured households. This finding underscores the role of insurance as a structural enabler of health service access, as lacking coverage reduces financial capacity and willingness to seek care, thereby constraining both utilization frequency and service diversity. Household poverty significantly reduced HSU ($B = -0.066$; 95% CI: -0.088 to -0.044 ; $p < 0.001$) and increased the likelihood of being uninsured ($B = 0.108$; 95% CI: 0.083 – 0.133 ; $p < 0.001$), confirming that economic deprivation operates upstream to restrict both enrollment in health coverage and the subsequent utilization of health services. Child age exerted a strong negative effect on HSU ($B = -0.933$; 95% CI: -0.984 to -0.882 ; $p < 0.001$), suggesting that younger children utilized health services more frequently, which is consistent with the higher density of scheduled health contacts, such as growth monitoring, immunization, and well-child visits, concentrated in the earliest months of life.

Table 3. Table of Indirect Influences and Total Influence

Variable	Indirect Influence (95% CI)	P value	Total Influence (95% CI)	P value
HSU	-	-	0.037 (-0.067 to 0.141)	0.489
type_serv	-	-	-0.001 (-0.102 to 0.099)	0.987
insurance	0.011 (-0.017 to 0.040)	0.437	0.285 (0.203 to 0.366)	<.001*
poverty	0.028 (0.016 to 0.040)	<.001*	0.165 (0.132 to 0.198)	<.001*
age	-0.034 (-0.132 to 0.063)	0.489	0.296 (0.180-0.411)	<.001*
residence	-	-	-0.099 (-0.185 to -0.012)	0.025

*Significant at a level of 5%.

Despite the null direct effects of HSU and type_serv on stunting, the broader structural model revealed important indirect pathways (Table 3). Being uninsured demonstrated a non-significant indirect effect on stunting ($B = 0.011$; 95% CI: -0.017 to 0.040 ; $p = 0.437$), mediated through HSU and type_serv, consistent with evidence that insurance status does not significantly affect primary care utilization and that financial barriers represent only one among several constraints including transportation costs, facility availability, service quality, and maternal health literacy (Cheng et al., 2025; Apriliani, 2025; Erlangga, Ali, & Bloor, 2019). Simbolon et al. (2021) demonstrate that even when services are delivered, population-level impact depends critically on coverage and quality (Simbolon et al., 2021), a structural weakness compounded by the Formative Evaluation's finding that multisectoral coordination remained misaligned, with nutrition-sensitive interventions consistently prioritized over nutrition-specific ones (UNICEF, 2024), and which the Regional Medium-Term Development Plan (RPJMD) 2025–2029 attempts to address by institutionalizing 8 Key Convergence Actions as an integrated coordinating mechanism across all relevant stakeholders (East Java Government, 2025). Nevertheless, the total effect of being uninsured on stunting remained significant and substantial ($B = 0.285$; 95% CI: 0.203 – 0.366 ; $p < 0.001$), driven predominantly by its direct pathway, reinforcing that the detrimental relationship between lacking insurance and stunting operates through mechanisms beyond service access constraints alone.

Household poverty demonstrated a significant indirect effect on stunting ($B = 0.028$; 95% CI: 0.016 – 0.040 ; $p < 0.001$), mediated through insurance status, HSU, and type_serv. Arief et al. (2025) found social protection card ownership significantly associated with higher stunting odds even after adjustment. The total effect of poverty on stunting ($B = 0.165$; 95% CI: 0.132 – 0.198 ; $p < 0.001$) was accordingly larger than its direct component alone. Presidential Regulation No. 13 of 2026 assigns coordinated multi-ministerial responsibilities for poverty-driven stunting (RI Government, 2026), though the Formative Evaluation found this coordination hampered by overlapping mandates and duplication of effort at provincial, district, and village levels (UNICEF, 2024). Child age demonstrated a non-significant indirect effect on stunting through HSU ($B = -0.034$; 95% CI: -0.132 to 0.063 ; $p = 0.489$), yet its total effect remained significant ($B = 0.296$; 95% CI: 0.180 – 0.411 ; $p < 0.001$), confirming that older children in East Java faced cumulatively higher stunting risk consistent with the critical window hypothesis in early childhood nutrition.

CONCLUSION AND RECOMMENDATION

This study examined the structural pathways through which health service utilization, insurance coverage, and household poverty shape stunting risk among children under five in East Java, using Generalized Structural Equation Modeling on provincial health survey data. The findings reveal that neither health service utilization frequency nor service type diversity exerted a significant direct effect on stunting, while lacking health insurance and household poverty both demonstrated significant direct and total effects. Child age emerged as a strong cumulative risk factor, reflecting the irreversible nature of stunting accumulation beyond the first 1,000 days, and residential setting produced a contextually nuanced effect that warrants further longitudinal investigation. Collectively, these results underscore that stunting reduction in East Java cannot be achieved through service access expansion alone, but requires simultaneous improvements in service quality, insurance coverage equity, and poverty alleviation that address the structural determinants operating upstream of household health-seeking behavior.

Based on these findings, provincial and national policymakers should prioritize three intersecting action areas. First, JKN enrollment barriers, particularly the civil registration bottleneck affecting newborns and the procedural complications introduced since December 2022, must be urgently simplified to ensure uninterrupted coverage during the most nutritionally critical developmental period. Second, expanding health service coverage targets, as mandated under the the Regional Medium-Term Development Plan (RPJMD) 2025–2029 through its 8 Key Convergence Actions framework, must be accompanied by quality assurance mechanisms that ensure posyandu and puskesmas staff deliver nutritionally substantive counseling, not merely record service contacts. Third, social protection programs targeting poor households should be better integrated with stunting-specific nutrition interventions, which can be initiated early through the BUAIAN program, an innovative provincial initiative designed to reduce maternal mortality rate (AKI) and infant mortality rate (AKB) in East Java by providing dedicated health monitoring and accompaniment for pregnant women from pregnancy through delivery.

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