

Multilevel Determinants Associated with Childhood Stunting in Southeast Asia: A Systematic Review

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ABSTRACT

Childhood stunting remains a major public health challenge in Southeast Asia, including Indonesia, Cambodia, the Philippines, Vietnam, and Malaysia, and is influenced by interconnected determinants operating at multiple levels. However, evidence integrating these determinants among children under five years remains fragmented. This systematic review aimed to synthesize evidence on multilevel determinants associated with childhood stunting among children aged 0–59 months in Southeast Asia. A systematic literature review following PRISMA guidelines was conducted. PubMed and Sciencedirect was searched for analytical observational studies published from 2020 to 2026. Eligible studies examined stunting or linear growth and at least one determinant among children aged 0–59 months in Southeast Asia. Determinants were organized into five levels: child, maternal, household, environmental/community, and health-system. Methodological quality was assessed using design-specific Joanna Briggs Institute critical appraisal tools. Findings were synthesized narratively. The search identified 456 records, of which 35 reports met the eligibility criteria and underwent quality appraisal. Child-level determinants were examined most frequently (30; 76.9%), followed by household (23; 58.9%) and maternal determinants (24; 61.5%). Environmental/community determinants were examined in 18 reports (46.2%), while health-system determinants were examined in 8 (20.5%). Reported associations included birth characteristics, dietary and infection-related factors, maternal height and education, socioeconomic conditions, water, sanitation and hygiene, and selected health services. Childhood stunting in Southeast Asia is associated with determinants across multiple levels. The findings support integrated, multilevel strategies addressing child, maternal, household, environmental, and health-system factors. Further longitudinal and multilevel research is needed to clarify interactions among these determinants.



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INTRODUCTION

Childhood stunting is a manifestation of impaired linear growth and is operationally defined as a length-for-age or height-for-age Z-score (LAZ/HAZ) below –2 standard deviations according to the WHO Child Growth Standards among children under five years of age (Onis et al., 2018; WHO-UNICEF, 2025). Stunting reflects cumulative or recurrent growth failure and is associated with adverse consequences for child development, health, educational attainment, and productivity later in life (WHO, 2015; WHO-UNICEF, 2025). Despite progress in reducing child undernutrition, stunting remains an important public health problem in Southeast Asia, including Indonesia, Cambodia, Viet Nam, the Philippines, and Myanmar, with substantial differences both between and within countries. These disparities occur in contexts characterized by varying socioeconomic conditions, food systems, environmental conditions, and health-service capacity (WHO, 2015; 2025).

Childhood stunting results from multiple, interconnected determinants rather than a single cause. Immediate determinants include inadequate dietary intake, inappropriate infant and young

child feeding practices, infection, low birth weight, and prematurity. These factors are influenced by maternal characteristics, household socioeconomic conditions, food security, caregiving practices, water, sanitation and hygiene (WASH), living environments, access to health services, and broader community and socioeconomic conditions (Tumilowicz, et al., 2018; Azriani et al., 2024). Determinants of linear growth may therefore operate simultaneously at multiple levels. In this review, multilevel determinants refer to interconnected factors associated with childhood linear growth that operate at the child, maternal, household, environmental/community, and health-system levels. These factors may act independently, cumulatively, or interactively.

Several previous evidence syntheses have examined the determinants of childhood stunting. Beal et al. reviewed the determinants of stunting in Indonesia and identified maternal, child, household, environmental, and health-related factors (Tumilowicz et al., 2018). Subsequently, Gusnedi et al. conducted a systematic review and meta-analysis of risk factors for stunting in Indonesia (Gusnedi et al., 2023). More recently, Togatorop et al. reviewed predictors of stunting among children aged 0–24 months across Southeast Asia and identified determinants spanning child, maternal, household, feeding, infection, health-care, WASH, sociocultural, and political-economic domains (Togatorop et al., 2024). Azriani et al. also mapped risk factors among children under five years of age in Southeast Asia and classified them into direct, underlying, and basic determinants (Azriani et al., 2024). In addition, domain-specific reviews have examined the relationship between WASH and stunting (Tan et al., 2025). Collectively, these studies have demonstrated the multifactorial nature of stunting; however, they differed in geographical coverage, age groups, determinant domains, and review methodologies.

Existing reviews have predominantly focused on a single country, a specific age group, a particular determinant domain, or broad evidence mapping. Although recent reviews in Southeast Asia have described the range of potential determinants, systematic synthesis of analytical observational evidence across multiple determinant levels among children aged 0–59 months remains limited. In particular, the consistency of associations across child, maternal, household, environmental/community, and health-system levels has not been sufficiently examined within a single regional framework. This review therefore complements, rather than duplicates, previous evidence syntheses by systematically synthesizing analytical observational studies from Southeast Asia and organizing their findings according to a multilevel conceptual framework. This approach also avoids the *a priori* assumption that any determinant level is more important than others.

Accordingly, this systematic review aims to synthesize the evidence on multilevel determinants associated with childhood stunting among children aged 0–59 months in Southeast Asia, with particular emphasis on the direction and consistency of associations across child, maternal, household, environmental/community, and health-system levels. The findings are expected to clarify the current evidence base, identify determinants with consistent or heterogeneous associations, and highlight those that remain insufficiently studied. These findings may inform the development of context-sensitive strategies to prevent and control childhood stunting in Southeast Asia.

METHOD

This systematic review is conducted and reported in accordance with the PRISMA 2020 guidelines (Page et al., 2021). Studies are considered eligible if they include children aged 0–59 months, investigate stunting or linear growth (HAZ/LAZ), evaluate at least one determinant, and use an analytical observational design, including cross-sectional, cohort, or case-control studies. Studies are eligible if they are conducted in Southeast Asian countries and published in English between January 2020 and the final search date in 2026. Systematic reviews and other types of reviews, protocols, editorials, studies conducted outside Southeast Asia, studies without relevant stunting or linear growth outcomes, and studies that do not provide sufficient information on determinants are excluded.

In this review, multilevel determinants are defined as interconnected factors associated with childhood linear growth that operate at the child, maternal, household,

environmental/community, and health-system levels. Studies are not required to explicitly use the term “multilevel determinants” to be eligible for inclusion.

A systematic search is conducted in PubMed/MEDLINE and ScienceDirect using a predefined search strategy applied to article titles, abstracts, and keywords. The search strategy uses combinations of terms related to the target population, stunting or growth faltering, determinants or risk factors, and Southeast Asia: ("Child, Preschool" OR "under five") AND ("Stunting" OR "growth faltering") AND ("Risk Factor" OR "Determinants") AND ("Southeast Asia"). Reference lists of relevant studies and reviews are also screened to identify additional records that meet the eligibility criteria.

After duplicate records are removed, titles and abstracts are screened, followed by full-text assessment according to the prespecified eligibility criteria. Reasons for exclusion at the full-text stage are recorded, and the study selection process is presented using a PRISMA 2020 flow diagram.

Data are extracted on author and publication year, country and study setting, study design, population and sample size, determinants, outcome measurement, statistical methods, and principal findings. Determinants are classified into five levels: child, maternal, household, environmental/community, and health-system levels.

Methodological quality is assessed using the appropriate Joanna Briggs Institute (JBI) Critical Appraisal Tool according to the study design. The appraisal considers the inclusion criteria, validity and reliability of exposure and outcome measurements, potential confounding, follow-up where applicable, and statistical analysis. Appraisal results are recorded as “Yes,” “No,” “Unclear,” or “Not Applicable” and are used to describe the methodological strengths and limitations of the included studies rather than to generate a validated numerical quality score.

Because the included studies differ in terms of populations, study settings, determinant definitions, outcomes, and analytical methods, the findings are synthesized using a structured narrative synthesis approach. Associations between determinants and outcomes are summarized by determinant level, with greater emphasis on adjusted estimates when available. The consistency and heterogeneity of findings are considered in relation to country, study design, population characteristics, and analytical approach.

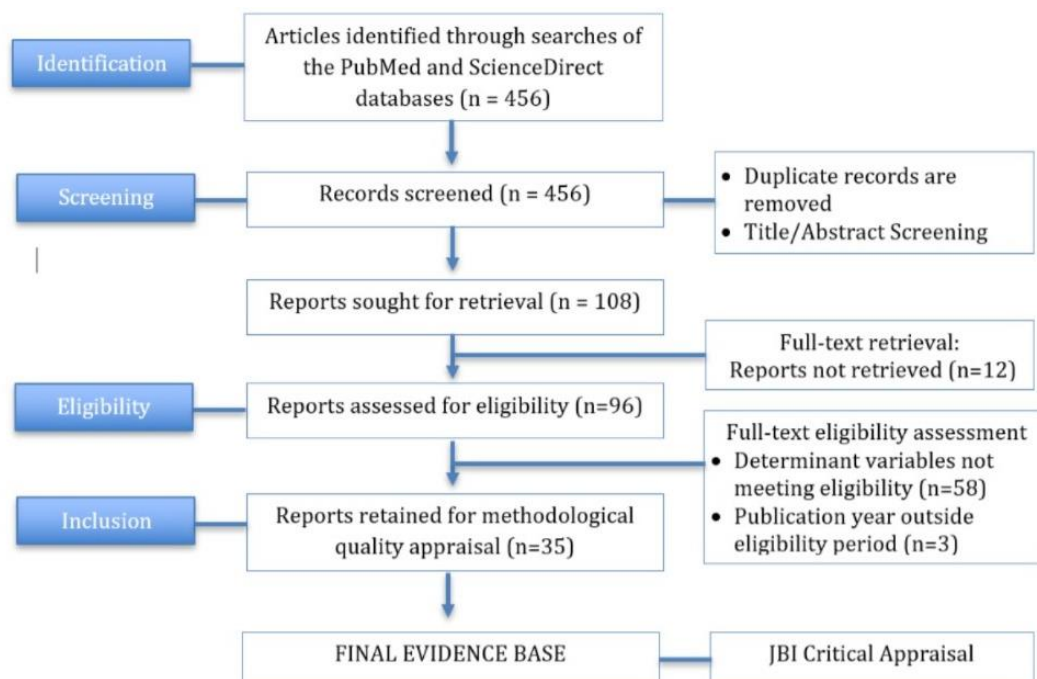


Figure 1. PRISMA flow diagram

The systematic search of PubMed and Science Direct identified 456 records. After title and abstract screening, 108 reports were retained for retrieval and full-text assessment. Of the 108 reports, 12 full texts could not be retrieved. Among the 96 reports assessed for eligibility, 58 were

excluded because the determinant variables did not meet the prespecified eligibility criteria and three were excluded because their publication year was outside the predefined eligibility period. Consequently, 35 reports underwent methodological quality appraisal.

RESULTS

After screening, 35 studies met the inclusion criteria and were included in the final analysis. Table 1 summarizes the characteristics of the selected studies.

Table 1. Characteristics of studies included in the systematic literature review

No	Author (year)	Country	Study design	Population	Determinants	Outcome	Main finding
1	Mulyaningsih et al. (2021)	Indonesia	Cross-sectional analysis of IFLS	n=8,045 children	Individual, household, community	Stunting/HAZ	Multilevel mixed-effects analysis of determinants across individual, household, and community levels.
2	Ayuningtyas et al. (2022)	Indonesia	Analytical cross-sectional	514 districts	Geographic, socioeconomic factors	Stunting	District-level OLS/geospatial analysis; ecological interpretation required.
3	Lai et al. (2022)	Cambodia	Analytical cross-sectional	n=4,036 children	Child, household, community	LAZ/stunting	GEE models accounted for clustering and confounding.
4	Thiede & Gray (2021)	Indonesia	Longitudinal secondary data	Age Child 0–23 and 24–59 months	Climate exposures	HFA/LAZ	Climate exposures were linked objectively; fixed effects and clustered SEs were used.
5	Kyaw et al. (2023)	Myanmar	Analytical cross-sectional	n=1,207 children	Sanitation, sex, vitamin A, maternal	Stunting/HAZ	Identified sanitation and child/maternal factors associated with stunting.
6	Ulep et al. (2022)	Philippines	Analytical cross-sectional	n=1,881 children	Maternal	HAZ/stunting	LPM and Oaxaca-Blinder decomposition quantified contributors to disparity.
7	Lee et al. (2022)	Malaysia	Analytical cross-sectional	n=15,331 children	Socio-demographic, maternal	Stunting/HAZ	Adjusted logistic regression identified associated factors.

No	Author (year)	Country	Study design	Population	Determinants	Outcome	Main finding
8	Apriliana et al. (2021)	Indonesia	Analytical cross-sectional	n=140 mother-toddler	Maternal pregnancy depression	Stunting	Maternal pregnancy depression was analyzed using correlation/chi-square.
9	Noor et al. (2022)	Indonesia	Cross-sectional; Riskesdas	n=1,218 toddlers	Socioeconomic, maternal, and toddler	Stunting/HAZ	Chi-square and logistic regression assessed risk factors.
10	Novitasari et al. (2020)	Indonesia	Analytical cross-sectional	n=262 mother-toddler	Maternal feeding practice	Stunting/HAZ	Bivariate analysis; no multivariable adjustment.
11	Wulandari et al. (2022)	Indonesia	Cross-sectional: national survey	n=11,887 children	Maternal characteristics	Stunting	Binary logistic regression with control variables.
12	Kusumawardani et al. (2023)	Indonesia	Cross-sectional; national survey	n=4,764 children; age <2 y	Maternal/child /household predictors	Stunting/HAZ	Adjusted logistic regression.
13	Sartika et al. (2021)	Indonesia	Analytical cross-sectional	n=559 infants	Prenatal and postnatal factors	Stunting/HAZ	Logistic regression; prenatal and postnatal predictors examined.
14	Thahir et al. (2023)	Indonesia	Prospective population-based cohort	Pregnant women	Maternal/infant	Stunting	Prospective follow-up with regression; attrition addressed.
15	Wulandari et al. (2025)	Indonesia	Analytical cross-sectional	Low-income Indonesian families	Maternal and socioeconomic	Stunting/HAZ	Multivariable logistic regression assessed maternal employment and covariates.
16	Ernawati et al. (2021)	Indonesia	Analytical cross-sectional; SEANUTS	n=1,008 children; age 6–59 months	Socioeconomic and micronutrient deficiencies	Stunting/HAZ	Associations assessed with adjustment for age, residence and sex.
17	Rahayuwati et al. (2023)	Indonesia	Analytical cross-sectional	Age under 5 y	Maternal, income and expenditure	Stunting	Regression analysis of socioeconomic/maternal determinants.
18	Harvey et al. (2022)	Cambodia	Cross-sectional; DHS 2014	n=1,365 children	Maternal and infant	HAZ/stunting	Structural path analysis examined direct/indirect pathways.

No	Author (year)	Country	Study design	Population	Determinants	Outcome	Main finding
19	Kusumajaya et al. (2025)	Indonesia (urban Bali)	Cross-sectional; Riskesdas 2018	n=846 children; age 6–59 months	Socio-demographic, healthcare, WASH	Stunting/HAZ	Multivariate logistic regression.
20	Turton et al. (2022)	Cambodia	Longitudinal cohort	n=894 children	socioeconomic and maternal	HAZ/WHZ	Logistic/multinomial regression of growth trajectories.
21	Basnet et al. (2022)	Bangladesh , Vietnam	Analytical cross-sectional	n=803 Bangladesh + 635 Vietnam	Maternal resources for care	LAZ	Regression adjusted for covariates and geographic clustering.
22	Muchlis et al. (2023)	Indonesia	Analytical cross-sectional	Rural; age under 5 y	Household cigarette smoke	Stunting	Adjusted association analysis.
23	Kamaruzaman et al. (2024)	Malaysia (Kuantan)	Case-control	n=160; age under 5 y	Feeding problems	Stunting	Binary logistic regression identified factors associated with stunting.
24	Purwanti et al. (2025)	Indonesia	Analytical cross-sectional; INSS 2021	n=70,267 toddlers; age 12–59 months	Maternal, economic status, birth weight	Stunting/HAZ	Cox regression estimated adjusted prevalence ratios.
25	Novianti et al. (2023)	Indonesia (West Java)	Case-control	n=212; age under 5 y	Sanitation, maternal hygiene and feeding	Stunting	Multiple logistic regression identified independent associations.
26	Suratri et al. (2023)	Indonesia	Cross-sectional; Riskesdas	n=1,643 children	Demographic and environmental	Stunting/HAZ	Multivariate logistic regression.
27	Maulina et al. (2022)	Indonesia	Cross-sectional; DHS	n=3,723 children; age under 5 y	Maternal, child, household, environment	Stunting/HAZ	Regression/bivariate analysis of stunting predictors.
28	Arief et al. (2025)	Indonesia	Cross-sectional; SKI 2023	n=78,049 (81,068 weighted) children	Immunization, diarrhea, water, residence	Stunting/HAZ	Crude and adjusted logistic regression with survey weights.
29	Manrique-de Hitta (2025)	Philippines	Analytical cross-sectional	n=628 caregivers/c hildren	Feeding and socio-demographic factors	Stunting/HAZ	Binary logistic regression with backward-stepwise full model.
30	Kpewou (2020)	Cambodia	Prospective longitudinal cohort	1,017 pregnant women	Maternal, infant, breastfeeding	LAZ/ stunting	Multivariable linear/logistic regression; missing covariates multiply imputed.

No	Author (year)	Country	Study design	Population	Determinants	Outcome	Main finding
31	Duong et al. (2023)	Cambodia	Analytical cross-sectional; DHS	Rural children 6–23 months	Food-market, household wealth, maternal	HAZ (continuous)	Multivariable linear regression accounting for complex survey design.
32	Renggli et al. (2021)	Cambodia	Longitudinal cohort; CAHENMS	1,595 eligible	Severe dental caries	HAZ	Multivariable logistic regression; attrition explored.
33	Permatasari et al. (2023)	Indonesia	Analytical cross-sectional	n=247 mother–child pairs	Socio-demographic, maternal	Stunting/HAZ	Multivariable logistic regression; confounding assessed by change in OR.
34	Belizario et al. (2021)	Philippines	Analytical cross-sectional	PSAC and SAC; school-age children	Soil-transmitted helminth infection	Stunting/HAZ	Pearson chi-square; no explicit confounding-control strategy.
35	Quyen et al. (2020)	Vietnam (rural)	Cohort; secondary analysis	236 infants	Prenatal food supplementation	WAZ/LAZ /WLZ	Multivariable linear mixed-effects models.

A total of 35 reports met the eligibility criteria. Studies were conducted in several Southeast Asian countries: Indonesia, Cambodia, the Philippines, Vietnam, and Malaysia. Most used analytical cross-sectional designs, with some cohort and case-control studies. The determinants covered all five levels of the framework: child, maternal, household, environmental/community, and health-system. Substantial heterogeneity in populations, determinant measurements, outcomes, and analytical methods supported narrative synthesis.

Table 2. Multilevel determinants associated with childhood stunting

Determinant level	Reports n (%)	Statistical evidence*	Direction of association	Representative first authors
Child	30 (76.9)	Present across several reports	Higher risk: adverse birth characteristics, infection; protective: dietary diversity, female sex	Mulyaningsih; Sartika; Quyen; Harvey; Ulep
Maternal	24 (61.5)	Present in several reports	Higher risk: shorter maternal stature, lower education, maternal depression; protective: greater maternal height	Lee; Soe; Apriliana; Sartika; Quyen; Noor; Wulandari
Household	23 (58.9)	Present, but heterogeneous	Higher risk with socioeconomic disadvantage; some crude associations attenuated after adjustment	Mulyaningsih; Maulina; Ernawati; Duong; Arief
Environmental/community	18 (46.2)	Present for selected WASH indicators	Protective: improved sanitation; higher risk: open defecation, poor WASH access	Mulyaningsih; Lai; Novianti; Arief
Health-system	8 (20.5)	Limited but present	Protective: immunization, vitamin A supplementation; findings for social protection require cautious interpretation	Arief

The included reports examined determinants across all five levels of the conceptual framework. Child-level determinants were investigated most often (30; 76.9%), followed by maternal determinants (24; 61.5%) and household determinants (23; 58.9%). Environmental/community determinants were examined in 18 reports (46.2%), whereas health-system determinants were assessed less often (8; 20.5%).

Verified associations included adverse birth characteristics, infection and dietary factors at the child level; maternal height and education at the maternal level; socioeconomic disadvantage at the household level; WASH conditions at the environmental/community level; and immunization and supplementation at the health-system level. The direction of associations varied across specific determinants and study contexts, and some crude associations were attenuated after adjustment. Thus, the evidence supports a multilevel pattern of determinants but does not establish a universally dominant determinant.

DISCUSSION

Principal findings

This systematic review indicates that childhood stunting in Southeast Asia is associated with determinants operating across multiple levels, including child, maternal, household, environmental/community, and health-system factors. This pattern is broadly consistent with previous reviews describing stunting as a multifactorial condition involving proximal and contextual determinants rather than a single exposure (Tumilowicz et al., 2018; Azriani et al., 2024; Togatorop et al., 2024).

The frequency with which a determinant domain was examined should not be interpreted as evidence that it has a stronger association with stunting. The direction and statistical significance of associations varied by determinant, population, setting, and analytical approach. Therefore, interpret the findings as evidence of a multilevel pattern of associations, rather than a ranking of determinants or evidence of causality.

Child-level determinants

Child-level factors were the most frequently examined determinants in this review. Several reports identified associations between stunting and birth-related characteristics, including low birth weight, prematurity, shorter birth length, and smaller-than-average birth size (Matsumoto-takahashi, 2023). These findings are consistent with previous evidence showing that impaired fetal and early postnatal growth is associated with subsequent linear growth faltering (Tumilowicz et al., 2018; Azriani et al., 2024; Togatorop et al., 2024).

Dietary intake and feeding practices were also examined in several studies. Some reports indicated that greater dietary diversity was associated with lower odds of stunting, whereas inadequate feeding practices were associated with poorer growth (Quyen et al., 2020; Picauly et al., 2024). Similar patterns have been reported in previous Southeast Asian reviews, which identified inadequate complementary feeding, poor-quality foods, inadequate breastfeeding, and infection among the factors associated with stunting (Azriani et al., 2024; Togatorop et al., 2024). Nevertheless, the heterogeneity of dietary indicators and feeding definitions limits direct comparison across studies.

Several reports identified infection as another child-level determinant. Although some studies found associations with diarrhea or other infections, the findings were not uniformly significant after adjustment (Kyaw et al., 2023). This suggests that infection may operate together with dietary, environmental, and socioeconomic conditions rather than as an isolated determinant (Lee et al., 2022; Noor et al., 2024). Because most included studies were cross-sectional, these associations should not be interpreted as demonstrating temporal or causal relationships.

Maternal determinants

Maternal characteristics represented an important determinant domain, particularly maternal height and education. Several reports indicated that shorter maternal stature was associated with higher odds of childhood stunting. This finding is consistent with the earlier Indonesian review by Beal et al., which identified low maternal height and education among the repeatedly reported determinants of child stunting (Tumilowicz et al., 2018). Maternal height may reflect both biological characteristics and cumulative nutritional and socioeconomic conditions experienced across the life course.

Maternal education was also associated with childhood stunting in several reports. Education may influence knowledge, caregiving practices, health-service utilization, and household decision-making (Dwi et al., 2022). Previous reviews similarly identified maternal education as an important contextual determinant of child growth (Tumilowicz et al., 2018; Azriani et al., 2024). Education may also be correlated with household socioeconomic position, making it difficult to distinguish its independent contribution without appropriate multivariable adjustment.

One study in this review also reported an association between maternal pregnancy depression and childhood stunting (Apriliana et al., 2022). This finding expands the maternal determinant domain beyond nutritional and sociodemographic characteristics and suggests the potential relevance of maternal psychosocial conditions. Nevertheless, the evidence remains limited, and further longitudinal studies are needed before drawing conclusions regarding temporal pathways.

Household and socioeconomic determinants

Household-level determinants were examined in 23 reports and included wealth, socioeconomic status, parental characteristics, food security, and household conditions. Overall, socioeconomic disadvantage tended to be associated with a greater likelihood of stunting, although some associations were attenuated after adjustment for other characteristics (Ernawati et al., 2021; Wulandari et al., 2022; Kusumajaya et al., 2025).

This finding is consistent with previous evidence from Indonesia and Southeast Asia showing that household socioeconomic conditions are repeatedly associated with childhood stunting (Tumilowicz et al., 2018; Gusnedi et al., 2023; Azriani et al., 2024). Socioeconomic position may influence several pathways simultaneously, including access to nutritious food, housing quality, sanitation, health services, and caregiving resources. Thus, household socioeconomic status may function not only as an individual predictor but also as an underlying condition that shapes exposure to several proximal determinants (Mulyaningsih et al., 2021).

Importantly, some associations in the included studies were significant in crude analyses but became weaker after adjustment (Sartika et al., 2021). This pattern emphasizes the importance of considering confounding and interrelationships among determinants. It also supports a multilevel framework in which socioeconomic conditions are considered in relation to, rather than separately from, maternal, child, environmental, and health-service factors.

Environmental and community determinants

Environmental/community determinants were examined in 18 reports, with WASH indicators being particularly prominent. Several studies reported that improved sanitation was associated with lower odds of stunting, whereas open defecation and inadequate access to water or sanitation were associated with poorer growth (Thiede and Gray, 2021; Lai et al., 2022). These findings are consistent with previous evidence syntheses identifying water, sanitation, and environmental conditions as relevant contextual determinants of childhood stunting (Tumilowicz et al., 2018; Azriani et al., 2024).

Nevertheless, not all WASH indicators demonstrated statistically significant associations after adjustment (Mulyaningsih et al., 2021). This variation may reflect differences in the quality and type of water and sanitation facilities, household practices, community conditions, and

exposure duration. The presence of a household facility alone may not fully capture a child's environmental exposure.

The findings support the interpretation that environmental conditions may contribute to stunting through interconnected pathways involving infection, hygiene, food safety, and the broader living environment. Because most evidence was observational and frequently cross-sectional, these pathways should be regarded as plausible explanations rather than established causal mechanisms (Lai et al., 2022; Kyaw et al., 2023; Siti et al., 2023).

Health-system determinants

Health-system determinants were the least frequently examined domain in this review. Available evidence included immunization, vitamin A supplementation, antenatal or postnatal care, and health-service utilization. Some reports identified protective associations for immunization or supplementation, while evidence for health-service utilization was less consistent (Sartika et al., 2021; Kyaw et al., 2023).

The relatively small number of studies addressing this domain is notable because previous reviews have emphasized health and healthcare access as part of the broader contextual determinants of stunting (Tumilowicz et al., 2018; Togatorop et al., 2024). The limited evidence in the present review may therefore represent a research gap rather than evidence of limited relevance.

Future studies should move beyond measuring service utilization alone and examine dimensions such as accessibility, continuity, quality, coverage, and integration of maternal and child health and nutrition services. Such evidence would strengthen understanding of how health-system factors interact with household and environmental determinants.

Implications for a multilevel approach

Taken together, the findings support a multilevel interpretation of childhood stunting in Southeast Asia. Previous reviews have similarly demonstrated that determinants span child, maternal, household, feeding, infection, health-service, WASH, social, and economic domains (Azriani et al., 2024; Togatorop et al., 2024). The present review extends this evidence by organizing analytical observational evidence from children aged 0–59 months into five interconnected levels.

The findings also highlight an important distinction between frequently investigated determinants and consistently associated determinants. Child and household factors were investigated more frequently, but this does not indicate that they are universally more influential than maternal, environmental, or health-system factors. Rather, the relatively limited evidence at the health-system level suggests an area requiring further investigation.

From a policy perspective, these findings support integrated strategies that combine child nutrition and infection prevention with maternal health and nutrition, socioeconomic support, improved WASH conditions, and accessible and effective health services. Such an approach is consistent with the broader conceptualization of stunting as the result of interconnected proximal and contextual conditions (Tumilowicz et al., 2018; Azriani et al., 2024; Togatorop et al., 2024).

The evidence indicates that childhood stunting in Southeast Asia is associated with determinants operating across multiple levels. Researchers most often studied factors at the child, household, and maternal levels, while environmental/community and particularly health-system determinants were less studied. The direction and magnitude of associations varied across contexts, and some crude associations were attenuated after adjustment.

The evidence supports a multilevel rather than single-factor interpretation of childhood stunting, but its predominantly observational nature requires cautious interpretation. This review's main contribution is to demonstrate the breadth of determinants across levels and to identify evidence gaps, particularly regarding community and health-system pathways, that future longitudinal and multilevel research should address.

CONCLUSION

This systematic review indicates that childhood stunting in Southeast Asia is associated with interconnected determinants operating across five levels: child, maternal, household, environmental/community, and health-system. Child, household, and maternal determinants were the most frequently examined, while evidence on environmental/community and particularly health-system determinants was more limited.

The findings support a multilevel approach to stunting prevention and control that integrates child nutrition and health, maternal conditions, household socioeconomic support, improved environmental conditions, and accessible health services. However, substantial heterogeneity across studies and the predominance of cross-sectional designs limit causal interpretation. Further longitudinal and multilevel studies are needed to clarify the interactions among determinants and strengthen the evidence for context-specific interventions in Southeast Asia.

AUTHOR'S DECLARATION

Authors' contributions and responsibilities

RH: Writing original draft, visualization, conceptualization, supervision (lead), validation (equal), review and editing; **DS:** Writing original draft, formal analysis, conceptualization.

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Availability of data and materials

The data analyzed in this study were obtained from published studies included in this systematic review. The extracted data are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no competing interests.

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