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Determinant Factors of Stunting in Toddlers in South Jakarta City, Indonesia: A Cross-Sectional Study

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ABSTRACT

OBJECTIVE: To identify factors associated with stunting among children aged 0–59 months in South Jakarta, Indonesia

METHODOLOGY: This study was carried out in a cross-sectional setting in South Jakarta, including 392 toddlers (aged - 59 months) randomly selected from 20,210 toddlers. Medical records were collected from community health centres, and mothers/caregivers were interviewed for qualitative data collection alongside a cross-sectional quantitative design. Stunting was defined as a height-for-age z-score of <-2 SD in the WHO standard form. Bivariate analysis was carried out using the Spearman Rank correlation test, while multivariate analysis was performed by binary logistic regression.

RESULTS: Fifty percent of 392 participants reported stunting (n = 196). Multivariate analyzes also found that independent factors of stunting were maternal age in Pregnancy≥35 years (AOR=2.96; 95% CI: 1.24–7.04; p=0.014), not receiving complementary feeding (AOR=2.70; 95% CI: 1.48–4.92; p=0.001), not exclusive breastfeeding (AOR=3.43; 95% CI: 1.87–6.30; p<0.001), ANC visits ≤5 times (AOR=3.40; 95% CI: 1.20–9.66; p=0.022), primary education (AOR=3.84; 95% CI: 1.64–9.01; p=0.002) and male gender (AOR=6.30; 95% CI: 1.90–20.86; p=0.003). Employment status was not associated with immunization. The model fit was found to be good (Hosmer–Lemeshow p=0.72; Nagelkerke R^2=0.24).

CONCLUSION: Exclusive breastfeeding, complementary feeding, ANC visits, maternal education, gestational age and toddler sex are independent determinants of stunting. An urban at-risk population in need of supportive nutritional interventions and social protective measures are a necessity.

KEYWORDS: Stunting, toddlers, exclusive breastfeeding, complementary feeding, antenatal care

INTRODUCTION

Stunting is one of the most severe constraints on human growth worldwide, caused by reduced linear growth due to chronic malnutrition from an early age.[1] In 2020, approximately 149.2 million children, 22 percent of all children, will be stunted, 21.8 percent of whom will be in Asia. South Asia is the largest region in Asia, with a prevalence of 30.7%, followed by Southeast Asia with 27.4%.[2]

At the regional level, Indonesia is among the countries with the highest burden of stunting in Southeast Asia. Indonesia has the third-highest stunting prevalence in Southeast Asia; this figure remains among the highest in Southeast Asia and globally[3]. At the national level, the 2018 Basic Health Survey reported a stunting prevalence of 30.8%4, while subsequent nutritional status surveys showed a downward trend: 27.7% (2019), 24.4% (2021), and 21.6% (2022) [4].

From a conceptual perspective, the reported recurrent determinants include family socioeconomic status and parental education[5], maternal knowledge regarding stunting/nutrition, maternal health conditions during Pregnancy, including nutritional status and antenatal care6, and infection and childhood illness[6]. In Jakarta, local evidence suggests a significant economic impact. In South Jakarta, studies found that families earning below the regional minimum wage had a significantly higher chance of stunting (around six to seven times) compared to those earning above the minimum wage[7].

However, most literature on factors influencing stunting in Indonesia is still cross-sectional and/or concerned with areas beyond Jakarta's urban context, as they lead to a sequential exposure and incident context. Not enough has been studied of stunting and the risk dynamics specific to the urban area. Thus, a study in South Jakarta City is required to determine the factors that decisively affect the incidence of stunting over time, as well as contextually demonstrating the need for reinforcing nutritional and social protection interventions for vulnerable urban populations.

The main objective of this study was to determine factors influencing stunting among toddlers in South Jakarta, Indonesia. This study contributes to the literature by mapping the determinants of stunting in a dense urban context (South Jakarta City) by employing routine health facility data (medical records and Community Health Centre data) combined with a population-based cross-sectional design. This study not only tests bivariate associations but also presents multivariate modeling with model fit indicators, thus strengthening the inference of independent factors.

METHODOLOGY

This research was Cross-sectional. With this design, association and risk prediction models can be examined systematically through both bivariate and multivariate analyses.
The research was conducted from May to December 2025, covering the stages of instrument preparation, instrument trials, enumerator training, sampling, health record searches, structured interviews, data processing, and statistical analysis. The study was carried out in South Jakarta, DKI Jakarta, Indonesia. The specific location was determined based on the epidemiology, which demonstrates very high stunting prevalence despite some degree of regional health program implementation.

Sample
The target population for this study encompasses mothers who have toddlers aged 0-59 months in South Jakarta. A significant pool of 20,210 toddlers was identified as potential participants, with 392 ultimately selected through simple random sampling. The sample size was determined using the Slovin formula.

$n = / (1 + Ne^2)$
$n = 20,210 / (1 + 20,210 (0.05)^2)$
$n = 392$

Information:
n = sample size
N = 20,210
e = 0.05

Simple random sampling provides equal selection probability for every subject within the sampling frame (N=20,210), thereby theoretically minimizing selection bias and maximizing external validity.
To maintain internal validity, this study established inclusion criteria comprising: (1) children aged 0–59 months registered at Primary Health Centers within the South Jakarta area, (2) availability of anthropometric data (length/height-for-age) at the health facility, (3) willingness of the mother/caregiver to participate and provide informed consent, and (4) possession of a Maternal and Child Health book for verification purposes. The exclusion criteria encompassed: (1) children with congenital abnormalities or chronic diseases that independently affect linear growth, (2) incomplete or inaccessible health records precluding stunting classification, (3) mothers/caregivers unable to communicate or respond to structured interviews, and (4) families who relocated outside the study area during the data collection period. The establishment of these criteria ensures sample homogeneity while acknowledging that such exclusions may limit generalizability to the broader population.

Data collection procedure
Data were collected through two main stages. First, historical data on toddlers were extracted from medical records at Primary Health Centers per village/sub-district and records of the South Jakarta City Health Office, covering health intervention history, immunization status based on service records, and anthropometric evaluations (length/height and available nutritional status indicators). Extraction was performed using a standardized extraction sheet (pro forma) to ensure consistency among enumerators and minimize transcription errors. Of the total 420 medical records extracted, 285 (67.86%) had complete

data on all variables, while 135 (32.14%) had one or more incomplete variables, particularly maternal age during Pregnancy, ANC visit frequency, and breastfeeding history.
Second, specifically for incomplete medical records, data completion and verification were conducted through structured questionnaires administered to mothers/caregivers. Variables completed included maternal age during Pregnancy, ANC visit frequency, breastfeeding history and practices (including exclusive breastfeeding), complementary feeding practices, and immunization status verification using the Maternal and Child Health book. Ten Enumerators were trained in structured questioning techniques, ethical probing, and consistent recording.
Drop-out criteria were established as follows: participants were excluded from analysis if (1) medical records could not be traced at the health facility, (2) the mother/caregiver could not be contacted after 3 (three) contact attempts, or (3) missing data exceeded 30% of the total required variables. A total of 28 participants met the drop-out criteria, resulting in a final sample of 392 toddlers.
Third, instrument trials, standardization procedures, confidentiality training, and quality control were conducted to ensure instrument reliability and internal consistency.

Operational definition

Stunting is a linear growth failure condition in toddlers, which is defined using height-for-age (H/A) or length-for-age (L/A) metrics. Stunting classification is based on anthropometric standards of the child (most often WHO), whereby toddlers are stunted if H/A or L/A z-score is <-2 SD, and not stunted if ≥-2 SD, according to anthropometric data in nutritional records/nutritional assessments available at health facilities. Antenatal care (ANC) is defined as the number of pregnancy visits. Description categories were ≤5 times and ≥6 times in the descriptive table. Exclusive breastfeeding was operationalized as providing only breast milk without feedings/drinks (other than medicines/supplements as indicated) for the first 6 months, with an appropriate yes/no code based on the mother/caregiver and/or KIA report, if available. Complementary feeding was defined as the practice of providing complementary feeding after 6 months that was scored as yes/no with respect to the study criteria. Immunization status was measured as received immunization (yes vs no) according to health facility records and/or KIA Handbook Verification. Education among mothers was also operationalized as the most comprehensive level of education (or, in this case, as ranking in the data sets used in the analyses). The pregnancy maternal age was provided in years and used numerically or categorically with the models of interest. Maternal employment was operationalized into working/not-working status or relevant employment categories.

Instrument

The research tools used were (1) a structured questionnaire for mothers/caregivers and (2) a health record extraction form. The items within the questionnaire include maternal demographic characteristics (i.e., maternal age at pregnancy, level of education, and occupation), maternal service utilization history (ANC frequency), infant and child feeding practices (exclusive breastfeeding, breastfeeding pattern, timing and practices of the introduction and provision of complementary feeding) and immunization information for supplementation/verification. Pilot testing was conducted to assess the quality of measurement. The reliability of the internal consistency of the questionnaire was high (Cronbach's alpha = 0.85). At the same time, the stability over time was evaluated by a one-week test–retest (r = 0.78), which indicated good stability. We retrieved documented historical and clinical data (subject pseudonym codes, summaries of health interventions, immunization status from service records, anthropometric/nutritional status assessment

scores for stunting classification) through an extraction sheet. Variables included stunting incidence outcomes (dichotomy), predominant exposures (complementary breastfeeding practices, exclusive breastfeeding, frequency of ANC), covariates (education, age at Pregnancy; occupation and immunization); and model quality (Nagelkerke pseudo-R^2, Hosmer–Lemeshow test and VIF).

The validity of the research instrument was evaluated through two main approaches. Content validity was assessed through expert judgment by a panel of nutritionists, midwives, and epidemiologists to ensure the suitability of each question item to the construct being measured. The Content Validity Index (CVI) was calculated based on the proportion of inter-rater agreement, with a CVI value of 0.89. Construct validity was tested through a pilot test of the instrument on a pilot sample, where each question item was analyzed using corrected item-total correlation. Items with a correlation value of $r \geq 0.38$ were considered. The medical record data extraction form was validated through cross-checking between the extracted data by two independent data collectors to ensure consistency and accuracy of recording. The entire validation process was conducted before the main data collection to ensure measurement quality.

Data Analysis

Statistical analyses were carried out in steps (descriptive, bivariate and multivariate analyses). At the descriptive stage, all categorical variables were expressed quantitatively as frequencies (n) and percentages (%) to describe the distribution of sample characteristics (n=392), including the coverage of nutritional services/practices such as ANC, exclusive breastfeeding, complementary feeding, and immunization. As an analytical step, for the bivariate stage we performed statistical analyses by testing the correlation between each independent variable and the incidence of stunting and ran a Spearman Rank Correlation Test because it is suitable for ordinal/dichotomous data and to detect monotonic relationships without requiring parametric assumptions. Significance was $p<0.05$. In multivariate analysis, binary logistic regression analyses were performed with the simultaneous effect of MP-ASI, breastfeeding, ANC and education on the odds of stunting, as OR (Exp(B)) with 95% CI, and also verified by model diagnostics (Nagelkerke R^2, Hosmer–Lemeshow test and VIF).

RESULTS

Table I displays the characteristics of 392 participants (mothers of toddlers) from the examination of factors that influence toddler stunting in South Jakarta City. The total sample included 196 stunted cases (50.00%) and 196 controls (50.00%). The mean maternal age at Pregnancy was 30.23 years. A notable percentage (65.82%) fell within the 20-35 age group (mean = 26.72 years); 4.08% of mothers were under 20 years (mean = 18.84 years), and 30.10% were over 35 years old (mean = 39.45 years). Regarding education, almost all subjects had a basic (38.01%), intermediate (35.20%) and tertiary (26.79%) level. For work, 57.40% were employed, and 42.60% were unemployed. Toddlers had almost equal gender distribution of 51.02% female and 48.98% male.

Table I: Respondent Characteristics

Characteristic	Frequency	Mean	Percentage
Age During Pregnancy (Years)		**30.23**	
20 to 35	258	26.72	65.82
≤ 20	16	18.84	4.08
≥ 35	118	39.45	30.10
Total	392		100.00
Stunting Status (The Toddlers)			
Stunted	196		50.00
Non-Stunted	196		50.00
Total	392		100.00
Education (Mothers)			
Basic (Elementary)	149		38.01
Middle (Junior-Senior)	138		35.20
High (University)	105		26.79
Total	392		100.00
Occupation (Mothers)			
Not Working	167		42.60
Working	225		57.40
Total	392		100.00
Gender of Toddlers			
Male	192		48.98
Female	200		51.02
Total	392		100.00

Table II presents the frequency distribution and bivariate analysis using Spearman's rank correlation for factors associated with stunting. Variables significantly associated with stunting include maternal age during pregnancy (p=0.001), complementary feeding (p<0.001), exclusive breastfeeding (p<0.001), antenatal care visits (p<0.001), maternal education (p<0.001), and toddler gender (p=0.004). Exclusive breastfeeding demonstrated the strongest correlation coefficient (0.453). Conversely, maternal occupation (p=0.611) and immunization status (p=0.301) showed no statistically significant association with stunting.

Table II: Frequency Distribution and Bivariate Analysis (Spearman's Rank Correlation) of Factors Associated with Stunting

Variables	Stunted n (%)	Non-Stunted n (%)	Correlation Coefficient	p-value
Age During Pregnancy (Years)			0.198	0.001
20–35 (ref)	110 (56.12)	148 (75.51)		
≤ 20	10 (5.10)	6 (3.06)		
≥ 35	76 (38.78)	42 (21.43)		
Complementary Feeding			0.372	< 0.001
Yes	58 (29.59)	131 (66.84)		
No	138 (70.41)	65 (33.16)		
Exclusive Breastfeeding			0.453	< 0.001
Yes	49 (25.00)	138 (70.41)		
No	147 (75.00)	58 (29.59)		
Antenatal Care			0.367	< 0.001
≤ 5 visits	138 (70.41)	66 (33.67)		
≥ 6 visits	58 (29.59)	130 (66.33)		
Education (Mothers)			0.224	< 0.001
Basic (Elementary)	91 (46.43)	58 (29.59)		
Middle (Junior–Senior)	70 (35.71)	68 (34.69)		
High (University)	35 (17.86)	70 (35.71)		
Gender of Toddlers			0.143	0.004
Male	110 (56.12)	82 (41.84)		
Female	86 (43.88)	114 (58.16)		
Occupation (Mothers)			0.026	0.611
Not Working	86 (43.88)	81 (41.33)		
Working	110 (56.12)	115 (58.67)		
Immunization (Toddlers)			−0.053	0.301
Yes	142 (72.45)	132 (67.35)		
No	54 (27.55)	64 (32.65)		

Results of multivariate logistic regression (**Table III**) indicate that the model had a good fit (Hosmer–Lemeshow $\chi^2 = 5.98$; $p = 0.72$), and moderate explanatory power (Nagelkerke's pseudo $R^2 = 0.24$). The VIF values varied between 1.02 and 1.83, which suggested no multicollinearity. Independent, and significant associations between variables and stunting, were: maternal age ≥35 years at Pregnancy (AOR = 2.96; 95% CI: 1.24–7.04; p = 0.014), not receiving complementary feeding (AOR = 2.70; 95% CI: 1.48–4.92; p = 0.001), not receiving exclusive breastfeeding (AOR = 3.43; 95% CI: 1.87–6.30; p < 0.001), fewer than five ANC visits (AOR = 3.40; 95% CI: 1.20–9.66; p = 0.022), basic education (AOR = 3.84; 95% CI: 1.64–9.01; p = 0.002), and male gender (AOR = 6.30; 95% CI: 1.90–20.86; p = 0.003). In contrast, employment status (AOR = 1.02; 95% CI: 0.78–1.34; p = 0.871) and immunization status (AOR = 1.05; 95% CI: 0.83–1.32; p = 0.709) were not significantly associated with stunting.

Table III: Multivariate Analysis Results Using Multiple Logistic Regression

Variables	B	SE	Wald χ^2	AOR	df	Sig.	VIF	95% CI Lower	95% CI Upper
(Constant)	–	–	–	–	–	–	–	–	–
Age During Pregnancy (≥35 vs 20-35)	1.086	0.442	6.03	2.96	1	0.014	1.25	1.24	7.04
Complementary Feeding (No vs Yes)	0.993	0.306	10.53	2.70	1	0.001	1.78	1.48	4.92
Exclusive Breastfeeding (No vs Yes)	1.232	0.310	15.80	3.43	1	< 0.001	1.83	1.87	6.30
Antenatal Care (≤5 vs. ≥6 visits)	1.223	0.533	5.26	3.40	1	0.022	1.54	1.20	9.66
Education (Basic vs High)	1.345	0.435	9.57	3.84	1	0.002	1.82	1.64	9.01
Gender of Toddlers (Male vs Female)	1.840	0.611	9.07	6.30	1	0.003	1.81	1.90	20.86
Immunization (Yes vs No)	0.044	0.118	0.14	1.05	1	0.709	1.17	0.83	1.32

Diagnostic Test:

- Pseudo R^2 (Nagelkerke) = 0.24
- Hosmer–Lemeshow test: $\chi^2 = 5.98$, p = 0.72

DISCUSSION

The findings revealed that maternal age during pregnancy, provision of complementary foods, exclusive breastfeeding, antenatal care (ANC) visits, maternal education, and toddler gender were significant predictors of stunting in the study. These findings are in line with the common consensus that stunting is a persistent growth retardation outcome, influenced by multilevel determinants including maternal variables, feeding practices of infants and young children and use of health services, as well as child-level measures[8]. Conceptually, the study's emphasis on breastfeeding and complementary feeding is consistent with evidence that poor child feeding practices are a major driver of stunting and require targeted behavior change communication and nutrition[9].

At the same time, the directionality of maternal age effects can vary across contexts. Evidence has suggested that increasing maternal age may reduce stunting probability, potentially via accumulated maternal knowledge and experience regarding childcare and health-seeking[10].

The strongest associations in the present study were observed for feeding variables: absence of complementary feeding and lack of exclusive breastfeeding were both strongly associated with higher odds of stunting in bivariate analysis, and they remained independently associated in multivariate analysis. This pattern is consistent with the broader evidence base emphasizing IYCF as a critical proximal determinant of linear growth[11], and with Indonesian findings that feeding practices and caregiving patterns are strongly related to stunting outcomes[12].

ANC visit frequency was strongly associated with stunting in the present analysis, with fewer visits linked to increased odds of stunting in bivariate analysis and remaining significant after adjustment in the multivariate model. This association is consistent with broader maternal and antenatal care pathways described as relevant to stunting risk, where maternal and antenatal factors are frequently identified contributors to child growth outcomes[13]. More generally, conceptual models of stunting highlight maternal nutrition and infection during Pregnancy and related maternal factors as key upstream determinants of fetal growth and subsequent child growth trajectories[14].

The present findings therefore support an interpretation that ANC may serve as a platform for prevention through maternal nutrition monitoring, health education, and early identification of pregnancy-related risks that can influence fetal and infant growth[15]. This interpretation is consistent with the broader emphasis in the literature that monitoring maternal nutritional status during Pregnancy is recommended given its links to child growth outcomes[16].

Maternal education was significantly associated with stunting in the present study, with lower education linked to higher odds of stunting in bivariate analysis and remaining independently associated in multivariate analysis. This is consistent with evidence from Indonesia demonstrating the importance of maternal education in relation to stunting among young children[17], as well as with broader cross-context evidence indicating that parents' (including mothers') education contributes to child growth differences and stunting risk[18]. Additionally, studies synthesizing determinants of maternal knowledge and nurturing care emphasize that maternal education is consistently associated with child stunting and functions as a major predictor across settings[19].

The present study found that male toddlers had higher odds of stunting than female toddlers, and this association remained significant in multivariate analysis. This aligns with evidence reported in population analyses where male children often have a higher chance of being stunted compared with female children[20].

Research focusing on low-income Indonesian families has directly investigated whether mothers' employment is a risk factor, indicating the relevance of contextual socioeconomic stratification when interpreting employment effects[21]. Thus, the present study's lack of association may reflect local conditions in South Jakarta where employment could be offset by improved household resources or alternative caregiving arrangements, consistent with the observation that stunting is shaped by multiple intersecting determinants rather than any single socioeconomic indicator[22].

Although the present model demonstrated acceptable calibration (Hosmer–Lemeshow p-value indicating good fit) and moderate explained variance, the broader literature indicates that many determinants of stunting lie outside maternal-child characteristics alone, particularly environmental conditions such as water, sanitation, and hygiene (WASH). Evidence from multiple settings shows that improved access to drinking water and sanitation is associated with reduced odds of stunting, and these relationships can persist after adjusting for sociodemographic confounders[23–27].

The primary novelty of this study lies in providing context-specific evidence on stunting predictors in urban South Jakarta, where maternal employment was not significantly associated with stunting, unlike findings from other Indonesian studies. This suggests that stunting determinants are context-dependent. Additionally, the study simultaneously integrated maternal, feeding, and child-level variables within a single multivariate model. Overall, the contribution is confirmatory and contextual, informing locally relevant intervention strategies.

CONCLUSION

This case-control study of 392 mothers with toddlers in South Jakarta City demonstrates that six independent factors significantly influence stunting. Multivariate logistic regression identified that lack of exclusive breastfeeding (AOR = 3.43), lack of complementary feeding (AOR = 2.70), fewer than five antenatal care visits (AOR = 3.40), maternal age ≥35 years at Pregnancy (AOR = 2.96), basic education level (AOR = 3.84), and male gender (AOR = 6.30) were significant predictors of stunting. Conversely, maternal employment status and immunization status were not significantly associated. These findings underscore the need for targeted interventions focusing on promoting exclusive breastfeeding and appropriate complementary feeding, enhancing antenatal care access, and providing nutritional education particularly for mothers with lower educational attainment and advanced maternal age.

PRACTICAL IMPLICATION

These findings have several concrete implications for health programs in South Jakarta. First, strengthening IYCF (Infant and Young Child Feeding) counseling at existing posyandu (integrated health posts) and community health centers should be prioritized, with targeted behavior change communication emphasizing timely introduction of complementary foods and exclusive breastfeeding for the first six months. Second, ANC (Antenatal Care) coverage should be increased beyond the minimum visit threshold by integrating maternal nutrition screening and growth monitoring protocols to identify at-risk pregnancies early. Third, community-based nutrition education programs should specifically target mothers with lower educational levels, using culturally appropriate messages and peer support models to improve feeding knowledge and practices. Fourth, given the higher odds of stunting among male toddlers, growth monitoring programs should incorporate sex-disaggregated surveillance to enable early detection and intervention. Finally, intersectoral collaboration that integrates WASH (Water, Sanitation, and Hygiene) improvements with nutrition-specific interventions is needed, given that unmeasured environmental determinants likely contribute substantial unexplained variance in current models.

STRENGTH AND LIMITATIONS

This study used a cross-sectional design, so the associations found are associative and cannot confirm causality or the temporal sequence of exposure to stunting events. However, the study's strength lies in the use of a multivariate prediction model with a goodness-of-fit test (Hosmer–Lemeshow $p=0.72$) and indications of low multicollinearity (VIF=0.98–1.83), resulting in relatively stable association estimates. This study also demonstrated standardized extraction sheets, enumerator training, and good instrument reliability ($\alpha=0.85$; test–retest $r=0.78$). Nagelkerke's pseudo R^2 value of 0.24 indicates that the model is only able to explain 24% of the variation in stunting incidence, so that the other 76% of the variation is influenced by factors that were not measured in this study, such as micronutrient intake, genetic factors, environmental sanitation conditions, and maternal health status during Pregnancy.

RECCOMENDATION

Future stunting prevention programs in South Jakarta should prioritize strengthening IYCF counselling at posyandu, emphasizing exclusive breastfeeding and timely complementary feeding; increasing ANC visit frequency with integrated maternal nutrition screening, particularly for mothers aged ≥35 years; and implementing community-based nutrition education targeting mothers with lower educational attainment. Sex-disaggregated growth monitoring should be adopted for early detection among male toddlers, and future research should employ longitudinal designs incorporating WASH and micronutrient variables.

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AUTHOR CONTRIBUTION

Achjar KAH: Substantial contributions to the conception or design of the work or the acquisition, analysis, or interpretation of data for the work and drafting the work or revising it critically for important intellectual content; AND Final approval
Alamsyah D: Substantial contributions to the conception or design of the work or the acquisition, analysis, or interpretation of data for the work, Drafting the work or revising it critically for important intellectual content; AND, Final approval
Gama IK: Substantial contributions to the conception or design of the work or the acquisition, analysis, or interpretation of data for the work, Drafting the work or revising it critically for important intellectual content; AND, Final approval

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