

Effectiveness of an Integrated Family Nursing Care Model for Children with Pneumonia (ASTANIA) on Caregiver Independence: A Quasi-Experimental Study

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ABSTRACT

Background: Caregivers of young children with pneumonia require preparation that extends from hospitalization into home care. The ASTANIA model integrates family-centered nursing, structured discharge planning, skills training, and community follow-up. **Objectives:** To evaluate whether ASTANIA was associated with greater family independence than routine nursing care. **Methods:** This quasi-experimental, non-equivalent control-group study enrolled 76 mothers of children aged 2-59 months with pneumonia (ASTANIA, n = 38; routine care, n = 38) from four public hospitals in Jakarta. Family independence was assessed at baseline and monthly for three months. Repeated binary outcomes were analyzed using generalized estimating equations (GEE). **Results:** All 76 participants completed Month 3. The proportion classified as independent increased from 15.8% to 71.1% in the ASTANIA group and from 21.1% to 44.7% in the routine-care group. In the final GEE model, ASTANIA was associated with higher odds of family independence than routine care (adjusted odds ratio [aOR] = 2.426, 95% CI 1.004-5.860; $p = 0.049$). At Month 3, the odds of independence were higher than at baseline (aOR = 7.141, 95% CI 3.733-13.633; $p < 0.001$). **Conclusion:** ASTANIA was associated with improved caregiver independence over three months. Because allocation was by site rather than random, the results support cautious effectiveness claims and require confirmation in multicenter randomized studies.

Keywords: ASTANIA Model; Childhood Pneumonia; Discharge Planning; Family-Centred Care; Family Independence; Transitional Care

INTRODUCTION

Pneumonia remains a major cause of illness and preventable death among children younger than five years, particularly in low- and middle-income countries (World Health Organization (WHO), 2022; Marangu & Zar, 2019). In Indonesia, its distribution reflects interacting environmental, nutritional, demographic, and service-access factors (Aithal *et al.*, 2023; Yusdiana *et al.*, 2025). These determinants continue after discharge, when families assume responsibility for medication, nutrition and hydration, infection prevention, symptom monitoring, and timely care-seeking. Indonesian caregivers have described uncertainty about pneumonia symptoms, initial home management, and when to seek formal care; unmet needs also include health promotion and nutritional guidance (Purwati *et al.*, 2021, 2022). Recent evidence shows that caregiver knowledge is related to attitudes and reported practices in families managing pediatric pneumonia (Ji *et al.*, 2026). Education alone

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may therefore be insufficient when caregivers also need observed skills practice, individualized discharge preparation, and continued professional support at home.

Family-centered care emphasizes information sharing, participation, respect, and collaboration. Contemporary reviews suggest that structured family involvement, caregiver education, and participation can improve parent knowledge and engagement, although intervention content and study quality vary (Mackintosh *et al.*, 2020; Aljawad *et al.*, 2025). Pediatric hospital-to-home transitions remain vulnerable to unclear instructions, inadequate follow-up, and uneven access to post-discharge resources (Kabajaasi *et al.*, 2023; Rocha *et al.*, 2026). Multicomponent transitional care commonly combines assessment, education, discharge planning, follow-up contact, and home visits (Marini *et al.*, 2025). The ASTANIA model was developed in Indonesia to connect hospital nursing care with community follow-up. Its formal Indonesian name is Model Asuhan Keperawatan Mandiri Keluarga dengan Balita Pneumonia (ASTANIA), translated here as the Integrated Family Nursing Care Model for Young Children with Pneumonia. It combines family-centered nursing during hospitalization, structured pneumonia-specific discharge planning, skills training, and scheduled home follow-up by community nurses. This study aimed to determine whether caregivers receiving ASTANIA had higher family independence over three months than caregivers receiving routine nursing care.

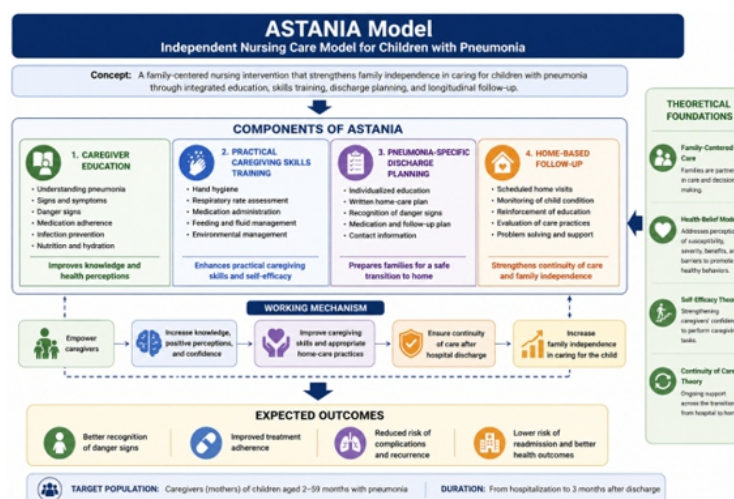


Figure 1: Conceptual Framework of the ASTANIA Integrated Family Nursing Care Model

Note: The model links hospital care, family education and skills development, discharge planning, and primary-care follow-up. The framework proposes improvements in caregiver knowledge, perceptions, practical skills, and family independence; the present analysis evaluates the observed independence outcome and does not establish mediation.

METHODOLOGY

Study Design and Setting

A quasi-experimental, non-equivalent control-group study was conducted from September 2019 to April 2020 in four public hospitals in Jakarta, Indonesia, and their related community health-service areas. The ASTANIA group was recruited from Rumah Sakit Umum Daerah (RSUD) Koja and RSUD Tarakan, whereas the routine-care group was recruited from RSUD Pasar Minggu and RSUD Cengkareng. Allocation was determined by hospital site to reduce contamination; participants were not randomized, and study-site effects could not be separated from treatment effects.

Participants and Sample Size

Mothers or maternal substitutes were recruited consecutively when their children were aged 2-59 months, hospitalized with pneumonia, and the caregiver could read, write, communicate, and consent to three months of follow-up. Caregivers of children with respiratory failure, hematologic malignancy, major congenital/non-infectious conditions, or other conditions that interfered with follow-up were excluded. The priori sample calculation used a two-proportion formula with a two-sided alpha of 0.05, 80% power, and proportions of 0.43 and 0.13 drawn from prior pneumonia-related studies. The minimum was 34 participants per group. Allowing 10% for

attrition increased the target to 38 per group ($n = 76$). All enrolled participants were represented at baseline and each monthly assessment in the dissertation analytic tables.

Intervention and Comparator

ASTANIA began during hospitalization and continued after discharge. Hospital nurses involved caregivers in family-centered care, delivered individualized pneumonia education, taught practical care, and completed a staged discharge plan. Education covered symptom and danger-sign recognition, medication and antibiotic use, nutrition and fluids, infection prevention, immunization, environmental risk reduction, and indications for seeking care. Skills training included hand hygiene, respiratory rate assessment, medication administration, and feeding and fluid management. After discharge, community/public-health nurses reviewed the discharge summary, reassessed the child and caregiver, reinforced the module, observed caregiving practice, provided feedback, and reassessed family independence during monthly home visits for three months. Telephone consultation was available during service hours. The comparator group received routine hospital nursing care, medical treatment, and conventional discharge information without the structured ASTANIA skills program or scheduled home follow-up.

Outcome Measures and Scoring

Family independence was the primary outcome and was measured separately from the three caregiver-behavior domains. The Family Independence Assessment contained seven decision- and care-related criteria scored dichotomously. The summed score ranged from 1 to 7; a score of 7 was classified as independent, and scores of 1-6 as not independent. Thus, knowledge, perception, caregiving skills, and family independence were not combined into a single composite score. Knowledge was measured using 20 items adapted from Siswanto *et al.* (2007) (correct = 1; incorrect or uncertain = 0; range 0-20), with 14-20 categorized as good. Health-related perceptions were assessed using 18 dichotomous Health Belief Model items (appropriate response = 1; inappropriate response = 0; range 0-18), with 13-18 categorized as good (Rosenstock, 1974; Janz & Becker, 1984). The adapted 38-item knowledge-perception questionnaire showed item-total correlations of 0.927-0.932 and Cronbach's alpha of 0.932 in pilot testing. Caregiving skills were observed across four checklists: hand hygiene (10 steps), respiratory-rate assessment (6 steps), medication administration (5 steps), and feeding/fluid management (7 steps). Each correctly demonstrated step received one point (range 0-28); complete performance (28) was classified as skilled. Assessors were trained in the standardized observation criteria. These domains were evaluated as supporting caregiver capabilities, while the seven-item independence classification was the primary endpoint.

Data Collection and Participant Flow

Baseline assessments were completed before intervention delivery. Follow-up assessments occurred at Months 1, 2, and 3 after discharge. The available dissertation tables report 38 observations per group at every time point; therefore, all 76 enrolled participants were included in the repeated-measures analysis, with no recorded withdrawals or losses to Month 3.

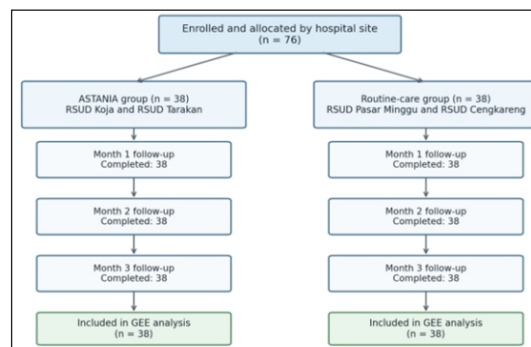


Figure 2: Participant Flow Through the Four Assessment Points

Statistical Analysis

Categorical variables are summarized as number and percentage. Baseline characteristics are reported descriptively; non-significant baseline tests were not interpreted as evidence of equivalence. Because family

independence was a repeated binary outcome, the primary analysis used population-averaged generalized estimating equations with a binomial distribution, logit link, and first-order autoregressive working correlation. The model estimated direct group and time effects across baseline and Months 1-3. The final model retained maternal age and employment as covariates. Effects are presented as adjusted odds ratios (aOR), 95% confidence intervals (CIs), and two-sided p-values. Statistical significance was set at $p < 0.05$. Analyses were performed in IBM SPSS Statistics version 22.

Ethical Considerations

This study received ethical approval from the Research Ethics Committee of the Faculty of Nursing, Universitas Indonesia, Indonesia, with reference number 280/UN2. F12D/HKP on 2nd April 2018.

RESULTS

Seventy-six mothers were enrolled (38 per group), completed Month 3, and were included in the analysis. Maternal education, occupation, and household income are described in Table 1. These characteristics were not used to claim baseline equivalence. At baseline, 6/38 (15.8%) ASTANIA participants and 8/38 (21.1%) routine-care participants met all seven independence criteria. The dissertation also documented baseline imbalances in knowledge, perception, and caregiving skills, reinforcing the need for cautious interpretation of this non-randomized comparison.

Table 1: Baseline Characteristics of Mothers by Study Group

Variable	Category	ASTANIA (n = 38), n (%)	Routine care (n = 38), n (%)
Education	Did not complete primary school	0 (0.0)	1 (2.6)
	Primary school	3 (7.9)	7 (18.4)
	Junior high school	7 (18.4)	13 (34.2)
	Senior high school	22 (57.9)	16 (42.1)
	Higher education	6 (15.8)	1 (2.6)
Occupation	Laborer	2 (5.3)	3 (7.9)
	Trader	1 (2.6)	0 (0.0)
	Private employee	6 (15.8)	6 (15.8)
	Housewife	28 (73.7)	28 (73.7)
	Teacher	1 (2.6)	1 (2.6)
Household Income	> Regional minimum wage	7 (18.4)	7 (18.4)
	= Regional minimum wage	15 (39.5)	16 (42.1)
	< Regional minimum wage	16 (42.1)	15 (39.5)
Family Independence	Independent (score = 7)	6 (15.8)	8 (21.1)

Note: The regional minimum wage was IDR 3,940,973 at the time of data collection. Baseline values are descriptive and do not establish equivalence.

Family independence improved over time in both groups (Table 2). By Month 3, 27/38 (71.1%) caregivers in the ASTANIA group and 17/38 (44.7%) in the routine-care group were independent, an unadjusted between-group difference of 26.3 percentage points. From baseline to Month 3, independence increased by 55.3 percentage points in ASTANIA and by 23.7 points in routine care; the descriptive difference in improvement was 31.6 percentage points. This provides a practical interpretation of the outcome without relying on an unvalidated continuous composite or minimum clinically important difference.

Table 2: Family Independence at Baseline and Monthly Follow-up

Assessment	ASTANIA independent, n (%)	Routine care independent, n (%)	Signed difference, percentage points
Baseline	6 (15.8)	8 (21.1)	-5.3
Month 1	15 (39.5)	11 (28.9)	10.5
Month 2	19 (50.0)	14 (36.8)	13.2
Month 3	27 (71.1)	17 (44.7)	26.3

Note: Signed difference = ASTANIA percentage minus routine-care percentage at the same assessment. Negative values indicate a lower proportion in ASTANIA.

The GEE analysis directly compared groups while accounting for repeated observations (Table 3). Across the study period, ASTANIA was associated with 2.426 times the adjusted odds of independence compared with routine care (95% CI 1.004-5.860; $p = 0.049$). Independent of group, the odds of independence increased at each follow-up and were highest at Month 3 (aOR = 7.141, 95% CI 3.733-13.633; $p < 0.001$). The wide confidence interval around the group effect indicates imprecision and supports cautious interpretation.

Table 3: Generalized Estimating Equation Model for Family Independence

Predictor	Adjusted odds ratio	95% CI	p-value
ASTANIA vs routine care	2.426	1.004-5.860	0.049
Month 1 vs baseline	2.419	1.463-4.000	0.001
Month 2 vs baseline	3.699	2.067-6.618	< 0.001
Month 3 vs baseline	7.141	3.733-13.633	< 0.001

Note: Population-averaged binary logistic GEE with an autoregressive working correlation. The final model included maternal age and employment as covariates. aOR > 1 indicates higher odds of meeting all seven independence criteria.

DISCUSSION

ASTANIA was associated with higher adjusted odds of family independence than routine care across repeated assessments. The practical difference was also visible in Month 3: 71.1% of ASTANIA caregivers met all seven independence criteria compared with 44.7% receiving routine care. The baseline-to-Month 3 increase was 31.6 percentage points greater in ASTANIA on a descriptive difference-in-change scale. These proportions are directly interpretable because independence is defined by seven observable criteria rather than an unsupported continuous composite. The adjusted group estimate was statistically significant but imprecise, with a confidence interval close to the null at its lower bound. Moreover, site-based allocation means that hospital practices or local population differences may partly explain the result. The evidence therefore supports an association and preliminary effectiveness signal, not definitive causal attribution.

One possible explanation is the multicomponent design. ASTANIA combined education, supervised skills practice, individualized discharge preparation, and repeated home-based reinforcement. Reviews of pediatric family-centered care identify information sharing, parental participation, targeted education, and structured collaboration as common intervention elements (Hodgson *et al.*, 2024; Aljawad *et al.*, 2025). Reviews of transitional care similarly emphasize assessment, caregiver teaching, coordination, and follow-up rather than a single discharge encounter (Marini *et al.*, 2025; Moore *et al.*, 2025). Evidence from structured pediatric discharge education also supports deliberately preparing families before the transition home (Zhang *et al.*, 2025). The ASTANIA components are consistent with these principles.

The pneumonia-specific focus is also relevant. Indonesian studies have documented caregiver knowledge gaps, delayed escalation, nutritional concerns, and unmet health-promotion needs (Purwati *et al.*, 2021, 2022). Recent pediatric pneumonia studies and syntheses suggest that integrated, comprehensive, and targeted nursing interventions may improve patient- and caregiver-related outcomes, while also noting heterogeneity among programs (Hu *et al.*, 2025; Zhou *et al.*, 2026). A 2026 caregiver study in *Mycoplasma pneumoniae* pneumonia found positive associations among knowledge, attitudes, and reported practices, supporting—but not proving—the behavioral logic of combining these domains (Ji *et al.*, 2026). Digital and booklet-based pneumonia education has also shown promise for strengthening early-detection knowledge (Mawaddah *et al.*, 2025). ASTANIA's monthly home visits may have offered opportunities to identify misunderstandings and rehearse care in the setting where it was performed. This is a plausible mechanism rather than a measured mediator (Blanchard, 2019). The study did not directly test confidence, perceived barriers, intervention fidelity, or which component (Blanchard, 2019) produced the effect. Larger samples and longer follow-up are needed to estimate effects on pneumonia recurrence, unscheduled visits, readmission, caregiver burden, and health-service use, given the potential long-term consequences of early-childhood pneumonia (Grimwood & Chang, 2015). These mechanisms should therefore be examined in future mediation and process evaluations.

The outcome has a direct practice interpretation: an independent caregiver met all seven assessed criteria for care-related decision-making and performance. At Month 3, the proportion meeting this threshold was 26.3 percentage points higher in ASTANIA. The study did not establish a minimum clinically important difference for an underlying continuous scale; instead, the binary threshold and absolute percentage-point contrast describe practical attainment. No conclusions can be drawn about recurrence, readmission, mortality, or healthcare use

because those outcomes were not measured. For nursing practice, the findings support testing a coordinated pathway in which hospital nurses begin family-centered preparation and community nurses continue assessment and reinforcement after discharge. Contemporary pediatric transition evidence emphasizes understandable instructions, caregiver readiness, coordination, and equitable access to follow-up, while implementation studies of integrated childhood-illness management underscore the importance of nursing capability and service context (Pelden *et al.*, 2025; Haspels *et al.*, 2025). Implementation should include fidelity monitoring, workload assessment, and clear referral pathways before routine adoption.

Limitations

Allocation by hospital rather than randomization creates risks of selection bias, site effects, and residual confounding. Baseline differences were present in supporting caregiver domains, and non-significant p-values cannot establish equivalence. The group-effect confidence interval was wide. Assessors were not reported as blinded; observational ratings may be influenced by knowledge of allocation, and local adaptation of measures limits comparability. The sample was small and geographically restricted, follow-up lasted three months, and child clinical outcomes and proposed mechanisms were not measured. Results should not be generalized beyond similar settings without replication.

Future Scope

Future studies should use multicenter randomized or carefully matched designs, prespeciate group-by-time contrasts, and report intervention fidelity, missing data, and blinded outcome assessment. Larger samples and longer follow-up are needed to estimate effects on pneumonia recurrence, unscheduled visits, readmission, caregiver burden, and health-service use, given the potential long-term consequences of early-childhood pneumonia. Pediatric transition research also supports testing family-reported transition quality and caregiver readiness as outcomes. Process and mediation analyses should determine whether changes in knowledge, perceptions, practical skills, confidence, or access to professional support explain independence. Digital follow-up may improve reach but should be evaluated against access inequities and should complement rather than replace clinically necessary home assessment.

CONCLUSION

The ASTANIA integrated family nursing care model was associated with greater caregiver independence than routine care during the three-month follow-up among families of young children hospitalized with pneumonia. This finding highlights the importance of examining caregiver independence across the transition from hospital to home. Because this was a non-randomized, site-based comparison, the observed association cannot be attributed definitively to ASTANIA. The study provides preliminary evidence to inform further investigation of integrated family nursing care in comparable pediatric settings.

CRedit Authorship Contribution Statement

N. H. P: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Original Draft, Project Administration. **Y. R:** Conceptualization, Methodology, Supervision, Validation, Writing - Review and Editing. **B. S:** Methodology, Clinical Validation, Supervision, Writing - Review & Editing. **B:** Methodology, Formal Analysis, Validation, Supervision, Review and Editing. **D. N:** Data Curation, Visualization, Writing - Review and Editing. **A. P:** Validation, Visualization, Writing - Review and Editing. All authors reviewed and approved the final manuscript and accepted accountability for the work.

AI Assistance Declaration

ChatGPT by OpenAI was used to assist with English-language refinement, manuscript organization, preparation of the point-by-point response, and consistency checking against the original dissertation. It was not used to generate or alter primary data or to introduce unverified statistical results. All AI-assisted text and numerical statements were critically reviewed, verified against the source documents, and revised by the authors. The authors take full responsibility for the accuracy, integrity, and final content of the manuscript.

Conflict of Interest

The authors declare that they have no competing interests.

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