

Biopsychosocial and Environmental Determinants of Toddler Health Service Utilization in Kediri City, Indonesia

ABSTRACT

Background: Utilization of child health services through routine visits to community health posts (Posyandu) is essential for growth monitoring, immunization, and disease prevention among toddlers. However, utilization remains influenced by a range of biological, psychological, social, and environmental factors. Understanding these determinants is important for developing effective community-based interventions. This study aimed to analyze the biopsychosocial and household environmental determinants of toddler health service utilization in Kediri City, Indonesia.

Methods: A cross-sectional study was conducted among 515 toddlers selected through random sampling. Data were collected through a validated and reliable structured questionnaire administered to mothers of toddlers. The outcome variable was toddler health service utilization through Posyandu visits, while the predictor variables included biological, psychological, social, and household environmental factors. Data were analyzed using chi-square tests and multivariable logistic regression. **Results:** Most toddlers (78.8%) attended Posyandu routinely. Bivariate analysis showed significant associations between toddler health service utilization and most biological, psychological, social, and household environmental factors ($p < 0.05$). In the multivariable model, paternal education, antenatal care history, parity, BPJS enrollment, access to health information, housing density, home ventilation, floor type, wall type, waste management, exposure to cigarette smoke, and access to clean water remained significant predictors of Posyandu utilization. BPJS enrollment was the strongest determinant (AOR = 8.076; $p < 0.001$). **Conclusion:** Toddler health service utilization is influenced by multiple biopsychosocial and environmental factors. Strengthening health insurance coverage, improving access to health information, and promoting healthy household environments may contribute to increased utilization of Posyandu services.

Keywords: Posyandu; toddler health services; health service utilization; household environment; BPJS enrollment

INTRODUCTION

The use of health services for infants and toddlers, particularly regular visits to community-based integrated health post (*Pos Pelayanan Terpadu* or Posyandu) clinics, is a key component of a primary health care system focused on health promotion and prevention. Posyandu clinics serve as a means of monitoring growth, detecting health problems early, and providing basic interventions for infants and toddlers at the community level [1][2]. Despite its important role, Posyandu utilization varies across regions and socioeconomic groups, suggesting that factors beyond service availability influence the use of child health services [3][4].

Globally, low utilization of child health services has been associated with household environmental conditions and socioeconomic circumstances. Studies have shown that children living in households with poor sanitation, exposure to secondhand smoke, and limited access to clean water are less likely to utilize preventive health services [5][6]. These challenges are often compounded by inadequate financial protection and low health literacy among families [7]. Consequently, the utilization of child health services cannot be separated from the environmental and socioeconomic context in which children are raised.

In Indonesia, Posyandu remains the backbone of primary health services for infants and toddlers at the village and subdistrict levels. Although national Posyandu coverage is relatively high, routine attendance among infants and toddlers remains suboptimal, particularly in densely populated urban settings and areas facing environmental challenges [1]. Previous studies have reported that families living in unhealthy household environments are less likely to attend Posyandu regularly, highlighting the influence of household environmental conditions on health service utilization [8][9]. Exposure to secondhand smoke is one of the most common environmental health issues in Indonesian households. Beyond its direct adverse effects on child health, secondhand smoke may also reflect lower levels of health awareness within families [10][11]. Studies have demonstrated that households with active smokers tend to exhibit less favorable health-seeking behaviors, which may influence parents' decisions to utilize Posyandu services for their children [12].

Basic sanitation conditions, including access to clean water and adequate toilet facilities, are also important determinants of child health. Poor sanitation increases the risk of infectious diseases and may hinder the utilization of preventive health services [13][14]. Evidence indicates that families with adequate access to clean water are more likely to use preventive health services than those with limited access, suggesting that household environmental quality plays an important role in health service utilization [15].

Socioeconomic factors further influence access to and utilization of health services. Health insurance coverage through BPJS has been shown to improve access to primary health care, including services for children [16][17]. However, some studies suggest that insurance coverage alone may not guarantee optimal service utilization in the absence of supportive household environmental conditions [18]. Therefore, environmental and socioeconomic determinants should be examined simultaneously to better understand patterns of child health service utilization [19][20]. Previous studies have also reported that household environmental exposures can influence healthcare-seeking behavior, including attendance at community health services, depending on the social context [21]. This highlights the complexity of how infectious diseases influence family health behaviors. The socio-ecological approach provides a useful framework for understanding health service utilization among infants and toddlers. This perspective emphasizes that health behaviors are shaped by interactions among individual, household, community, and health-system factors [22][23]. In the context of Posyandu, the socio-ecological model helps explain how environmental and socioeconomic conditions influence family decisions regarding the utilization of child health services [24]. Although previous studies have identified environmental and socioeconomic determinants of maternal and child health behaviors [25][26], most have focused primarily on health outcomes such as stunting or infectious diseases rather than on health service utilization itself. Furthermore, limited studies have simultaneously examined biological, psychological, social, and environmental determinants within a single analytical framework. Addressing this gap is important for developing more effective interventions to improve child health service utilization.

Therefore, this study aimed to analyze the biopsychosocial and environmental determinants of health service utilization among toddlers in Kediri City using a socio-ecological approach. Specifically, the study examined biological factors (maternal and paternal age and education),

psychological factors (antenatal care history, parity, maternal malnutrition during pregnancy, multiple pregnancy history, and comorbidities), social factors (parental occupation, BPJS coverage, and access to health information), and household environmental factors (housing density, ventilation, building materials, waste management, exposure to secondhand smoke, toilet distance, and access to clean water). The findings are expected to provide evidence for developing community- and environment-based interventions to improve sustainable utilization of child health services.

MATERIAL AND METHODS

Study Design and Setting

This quantitative cross-sectional study was conducted in Kediri City, Indonesia, in 2025 to examine the biopsychosocial and environmental determinants of toddler health service utilization. The predictor variables included biological factors (maternal age, paternal age, maternal education, and paternal education), psychological factors (antenatal care history, parity, maternal malnutrition during pregnancy, pregnancy complications, and comorbidities), social factors (maternal occupation, paternal occupation, BPJS coverage, and access to health information), and household environmental factors (housing density, home ventilation, building materials, household waste management, exposure to secondhand smoke, toilet distance from the house, and access to clean water).

Population and Sample

The study population consisted of all toddlers residing in Kediri City, Indonesia, in 2025, totaling 2,926 toddlers. The required sample size was determined using the Slovin formula with a margin of error of 4%:

$$n = \frac{N}{1 + Ne^2} = \frac{2926}{1 + 2926 (0.04)^2} = \frac{2926}{5.6814} = 514.98 \approx 515$$

where,

n = required sample size,

N = population size (2,926 toddlers),

e = margin of error (0.04).

Therefore, the minimum required sample size was 515 toddlers. Participants were selected using simple random sampling to ensure that each eligible toddler had an equal probability of being included in the study.

Data Collection

Primary data were collected using a structured questionnaire developed by the researchers based on the Indonesian Ministry of Health guidelines for maternal and child health services and a literature review on the determinants of health service utilization. The questionnaire was administered to mothers of toddlers and consisted of five sections.

The first section collected the respondents' biological characteristics, including maternal age, paternal age, maternal educational level, and paternal educational level. All data were collected using closed-ended questions and measured on nominal or ordinal scales, depending on the characteristics of each variable. The second section measured psychological factors and maternal health history, including antenatal care (ANC) history, parity, chronic energy deficiency (CED) during pregnancy, pregnancy complications, and comorbidities. Data were collected through closed-ended questions with "Yes" or "No" response options based on the respondents' health history. The third section measured social factors, including maternal occupation, paternal occupation, National Health Insurance (BPJS) enrollment, and access to health information. Access to health information was assessed based on respondents' exposure to information from health workers, mass media, and digital media. The fourth section measured household environmental conditions, including housing density, home ventilation, building materials, household waste management, exposure to secondhand smoke indoors, the distance of the toilet from the house, and access to clean water. Household environmental conditions were assessed using sanitation indicators based on the environmental health standards of the Indonesian Ministry of Health. The fifth section measured the study outcome, namely toddler health service utilization through Posyandu visits. This variable was assessed based on the frequency of Posyandu visits during the previous 12 months and was categorized as routine or non-routine according to the Posyandu

program guidelines. Whenever available, information on Posyandu attendance was verified using the Maternal and Child Health (MCH) Handbook or Posyandu attendance records to minimize recall bias.

Before data collection, the questionnaire underwent content validation by three experts in public health and maternal and child health. A pilot study was subsequently conducted among 30 respondents with characteristics similar to those of the study population. The validity test showed that all questionnaire items had an item-total correlation coefficient of ≥ 0.20 , confirming their validity. The reliability test demonstrated a Cronbach's alpha coefficient of ≥ 0.70 for each questionnaire domain, indicating good internal consistency. Therefore, the questionnaire was considered suitable for use in the study.

Variables and Data Source

All study data were obtained through primary data collection using a structured questionnaire administered to mothers of toddlers. The outcome variable was toddler health service utilization through Posyandu visits, defined as the utilization of Posyandu services for growth and development monitoring, immunization, vitamin supplementation, nutrition counseling, and other basic health services. Utilization was assessed based on the frequency and regularity of Posyandu visits during the previous 12 months. The predictor variables included biological, psychological, social, and household environmental factors. Biological factors included maternal age, paternal age, maternal education, and paternal education. Age was measured in years, whereas education was categorized according to the highest level of formal education completed.

Psychological factors included antenatal care (ANC) history, parity, maternal malnutrition during pregnancy, pregnancy complications, and comorbidities. These variables were assessed based on respondents' self-reported reproductive and health histories. Social factors included maternal occupation, paternal occupation, BPJS coverage, and access to health information. Employment status was categorized according to current occupation, BPJS coverage was recorded as insurance ownership status, and access to health information was assessed based on respondents' exposure to health-related information sources. Household environmental factors included housing density, home ventilation, building materials, household waste management, exposure to secondhand smoke, toilet distance from the house, and access to clean water. These variables were measured using household environmental and sanitation indicators included in the questionnaire.

The questionnaire was developed based on relevant indicators of child health service utilization and household environmental conditions. All collected data were coded and entered into a database for statistical analysis.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 23. Descriptive statistics were used to summarize participant characteristics and study variables. Bivariate analysis was performed using the chi-square test to examine the associations between the predictor variables and toddler health service utilization through Posyandu visits. Variables that showed statistically significant associations in the bivariate analysis were entered into a multivariable logistic regression model to identify independent determinants of toddler health service utilization. Statistical significance was set at $p < 0.05$.

2.5 Ethical Considerations

Ethical approval was obtained from the Research Ethics Committee of Institut Ilmu Kesehatan Bhakti Wiyata Kediri (Reference No. 32/FTMK/EP/I/2025). Participation was voluntary, and informed consent was obtained from all respondents prior to data collection. Personal identifiers were removed from the dataset to ensure confidentiality and anonymity in accordance with ethical principles for health research.

RESULTS

Table 1 shows the characteristics of the study respondents based on biological factors, namely the mother's age, the father's age, the mother's educational level, and the father's

educational level. Most mothers (90.3%) and fathers (98.4%) were aged ≥ 36 years. In addition, the majority of mothers (67.2%) and fathers (74.6%) had received formal education.

Table 1. Biological characteristics of the respondents (n = 515)

No	Predictors	Frequency	Percentage (%)
Mother's age			
1	< 36 years	50	9.7
2	≥ 36 years	465	90.3
Father's age			
1	< 36 years	8	1.6
2	≥ 36 years	507	98.4
Mother's education level			
1	No schooling	169	32.8
2	Schooled	346	67.2
Father's education level			
1	No schooling	131	25.4
2	Schooled	384	74.6

Table 2 summarizes the psychological characteristics of the respondents. Most mothers had completed antenatal care visits (72.8%) and were multiparous (65.0%). The majority reported no history of maternal malnutrition during pregnancy (78.4%), pregnancy complications (94.0%), or comorbid conditions (99.2%). The study results indicate that the majority of mothers had a complete history of antenatal care, were multiparous, had no history of pregnancy with KEK, had no history of concomitant pregnancy, and had no history of concomitant diseases.

Table 2. Psychological characteristics of the respondents (n = 515)

No	Predictors	Frequency	Percentage (%)
Mother's antenatal care history			
1	Complete	375	72.8
2	Incomplete	140	27.2
Mother's parity history			
1	Primipara	180	35.0
2	Multipara	335	65.0
3	Grande multipara	0	0.0
History of maternal malnutrition during pregnancy (KEK)			
1	No	404	78.4
2	Yes	111	21.6
History of pregnancy complications			
1	No	484	94.0
2	Yes	31	6.0
History of concomitant medical conditions			
1	No	511	99.2
2	Yes	4	0.8

Table 3 shows the social characteristics of the respondents. Most mothers were unemployed (63.3%), whereas nearly all fathers were employed (98.8%). The majority of respondents were enrolled in BPJS (81.7%) and had access to health information (85.4%). The results indicate that most mothers are not employed, while most fathers are employed; they have BPJS coverage and have access to health information.

Table 3. Social characteristics of the respondents (n = 515)

No	Predictors	Frequency	Percentage (%)
Mother's occupation			
1	Employed	189	36.7
2	Unemployed	326	63.3

Father's occupation			
1	Employed	509	98.8
2	Unemployed	6	1.2
BPJS enrollment			
1	Yes	421	81.7
2	No	94	18.3
Access to health information			
1	Yes	440	85.4
2	No	75	14.6

Table 4 presents the household environmental characteristics of the respondents. Most households had adequate ventilation (75.0%), tile flooring (62.5%), brick walls (50.9%), and access to waste collection services (51.1%). Most respondents reported no exposure to cigarette smoke inside the home (62.3%), had a toilet located within 10 meters of the house (53.2%), and had access to clean water (79.4%). Housing density was relatively balanced between low-density (49.1%) and high-density (50.9%) households. The study results indicate that the majority of families live in dwellings with adequate ventilation, ceramic flooring, brick walls, waste management via collection services, no exposure to secondhand smoke, a toilet located within 10 meters of the house, and access to clean water.

Table 4. Household environmental characteristics of the respondents (n = 515)

No	Predictors	Frequency	Percentage (%)
Housing density			
1	Low	253	49.1
2	High	262	50.9
Home ventilation			
1	Adequate	386	75.0
2	Indequate	129	25.0
Floor type			
1	Tile	322	62.5
2	Cement or dirt	193	37.5
Wall type			
1	Brick	262	50.9
2	Wood or wattle-and-daub	253	49.1
Waste management			
1	Collected	263	51.1
2	Burned	252	48.9
Exposure to cigarette smoke			
1	No	321	62.3
2	Yes	194	37.7
Distance of toilet from home			
1	< 10 meters	274	53.2
2	≥ 10 meters	241	46.8
Access to clean water			
1	Yes	409	79.4
2	No	106	20.6

Table 5 shows the distribution of toddler health service utilization. Of the 515 toddlers included in the study, 406 (78.8%) attended Posyandu routinely, while 109 (21.2%) attended non-routinely.

Table 5. Utilization of health services for toddlers (n = 515)

No	Outcome	Frequency	Percentage (%)
1	Routine attendance	406	78.8
2	Non-routine attendance	109	21.2

Table 6 presents the results of the bivariate analysis using the chi-square test. Significant associations were observed between toddler health service utilization and all biological factors, including maternal age ($p=0.001$), paternal age ($p=0.002$), maternal education ($p=0.020$), and paternal education ($p=0.006$). Significant associations were also found for psychological factors, including antenatal care history ($p<0.001$), parity ($p<0.001$), history of maternal malnutrition during pregnancy ($p=0.007$), pregnancy complications ($p=0.009$), and comorbid conditions ($p=0.008$).

Table 6. Bivariate analysis of factors associated with toddler health service utilization

No	Predictors	Outcome	OR value	p value
Biological factors				
1	Mother's age	Related to health care visits for toddlers	0.355	0.001
2	Father's age		1.116	0.002
3	Mother's education level		1.452	0.020
4	Father's education level		1.557	0.06
Psychological factors				
5	Mother's antenatal care history	Related to health care visits for toddlers	2.551	< 0.001
6	Mother's parity history		0.416	< 0.001
7	History of pregnancy with KEK		0.966	0.007
8	History of concomitant pregnancy		0.888	0.009
9	History of concomitant medical conditions		1.271	0.008
Social factors				
10	Mother's occupation	Related to health care visits for toddlers	0.614	0.025
11	Father's occupation		1.879	0.003
12	BPJS enrollment		16.567	< 0.001
13	Access to health information		10.234	< 0.001
Household environmental				
14	Housing density	Related to health care visits for toddlers	2.001	0.002
15	Home ventilation		3.157	< 0.001
16	Floor type		2.908	< 0.001
17	Wall type		4.174	< 0.001
18	Waste management		4.216	< 0.001
19	Exposure to cigarette smoke		3.878	< 0.001
20	Distance of toilet from home		4.448	< 0.001
21	Access to clean water		5.000	< 0.001

Regarding social factors, maternal occupation ($p=0.025$), paternal occupation ($p=0.003$), BPJS enrollment ($p<0.001$), and access to health information ($p<0.001$) were significantly associated with toddler health service utilization. All household environmental factors were also significantly associated with Posyandu utilization, including housing density ($p=0.002$), home ventilation ($p<0.001$), floor type ($p<0.001$), wall type ($p<0.001$), waste management ($p<0.001$), exposure to cigarette smoke ($p<0.001$), toilet distance from the house ($p<0.001$), and access to clean water ($p<0.001$).

Table 7 presents the results of the multivariable logistic regression analysis. Significant predictors of toddler health service utilization included maternal age (OR=0.199; $p=0.002$), paternal education (OR=4.030; $p=0.012$), antenatal care history (OR=7.033; $p<0.001$), parity (OR=0.205; $p<0.001$), BPJS enrollment (OR=8.076; $p<0.001$), access to health information (OR=6.604; $p<0.001$), housing density (OR=2.107; $p=0.038$), home ventilation (OR=2.563; $p=0.013$), floor type (OR=2.053; $p=0.042$), wall type ($p<0.001$), waste management (OR=4.953; $p<0.001$), exposure to cigarette smoke (OR=3.061; $p=0.002$), and access to clean water (OR=2.883; $p=0.013$).

Table 7. Multivariable logistic regression analysis of factors associated with toddler health service utilization

Predictors	Adjusted OR (AOR)	95% CI	p value
Biological factors			
Mother's age	0.20	0.07-0.57	0.002
Father's age	1.36	0.65-0.82	0.415
Mother's education level	1.65	0.69-3.98	0.263
Father's education level	4.03	1.36-11.97	0.012
Psychological factors			
Mother's antenatal care history	7.03	3.09-16.03	< 0.001
Mother's parity history	0.20	0.09-0.45	< 0.001
History of pregnancy with KEK	1.30	0.54-3.12	0.553
History of concomitant pregnancy	0.90	0.22-3.66	0.882
History of concomitant medical conditions	5.79	0.01-0.10	0.999
Social factors			
Mother's occupation	0.59	0.28-1.23	0.161
Father's occupation	0.93	0.09-11.26	0.958
BPJS enrollment	8.08	3.08-21.17	< 0.001
Access to health information	6.60	2.31-18.90	< 0.001
Household environmental			
Housing density	2.11	1.04-4.26	0.038
Home ventilation	2.56	1.22-5.38	0.013
Floor type	2.05	1.03-4.10	0.042
Wall type	1.18	4.66-26.79	< 0.001
Waste management	4.95	2.23-10.98	< 0.001
Exposure to cigarette smoke	3.06	1.496-27	0.002
Distance of toilet from home	1.54	0.74-3.21	0.251
Access to clean water	2.88	1.25-6.63	0.013

In contrast, paternal age, maternal education, history of maternal malnutrition during pregnancy, pregnancy complications, comorbid conditions, maternal occupation, paternal occupation, and toilet distance from the house were not significantly associated with toddler health service utilization after adjustment for other variables ($p > 0.05$). The logistic regression model yielded a Nagelkerke R^2 value of 0.687, indicating that the variables included in the model explained 68.7% of the variation in toddler health service utilization, while the remaining 31.3% was attributable to factors not included in the model.

DISCUSSION

This study examined the biopsychosocial and environmental determinants of toddler health service utilization through Posyandu visits in Kediri City. The findings indicate that the utilization of health services among toddlers is influenced by a combination of biological, psychological, social, and household environmental factors, supporting the socio-ecological perspective that health behaviors are shaped by multiple interacting determinants.

Biological factors, particularly parental age and education, were associated with toddler health service utilization. Most parents in this study were aged 36 years or older and had received formal education. Older parents generally possess greater life experience, maturity, and decision-making capacity regarding family health matters [27]. Likewise, parental education is an important social determinant of health because it influences health literacy, access to information, and understanding of the benefits of preventive healthcare services. Previous studies have shown that parents with higher educational attainment are more likely to utilize child healthcare services and engage in health-promoting behaviors [28] [29].

In the multivariable analysis, paternal education remained a significant predictor of Posyandu utilization, highlighting the importance of fathers' educational attainment in supporting child health-seeking behavior. In many households, fathers continue to play a central role in financial decision-making and the allocation of household resources, including healthcare-related expenditures. Higher educational attainment among fathers may therefore facilitate a better

understanding of the long-term benefits of preventive child health services and increase support for routine Posyandu attendance. Furthermore, educated fathers are more likely to encourage shared decision-making with their spouses, seek reliable health information, and prioritize investments in child health. This interpretation is supported by previous evidence showing that fathers with higher educational levels tend to have greater awareness of preventive healthcare and are more likely to support access to child health services through appropriate financial and health-related decisions [30]. This finding underscores the need for interventions aimed at improving toddler health service utilization to not only target mothers but also actively engage fathers through family-centered health education and community-based health promotion programs.

Psychological factors also played an important role. Mothers with a history of complete antenatal care (ANC) utilization were more likely to utilize Posyandu services for their children. ANC provides opportunities for health education, counseling, and continuous interaction with healthcare providers, which may increase awareness of the importance of monitoring child growth and development after birth [31]. Similar findings have been reported in previous studies showing that positive maternal experiences with healthcare services during pregnancy are associated with greater utilization of child health services [32]. Parity was also significantly associated with Posyandu utilization. Mothers with previous childbirth experience may have greater confidence and knowledge regarding child health needs, enabling them to recognize the importance of regular health monitoring for toddlers [33] [34]. Similarly, maternal knowledge, positive attitudes toward Posyandu, and prior exposure to health education have been shown to increase participation in community-based child health services, whereas inadequate knowledge and limited motivation remain important barriers to utilization [30]. These findings can be interpreted within the continuum of maternal and child healthcare, whereby healthcare utilization during pregnancy influences subsequent health-seeking behaviors after childbirth. Mothers who regularly attended ANC are more likely to establish trusting relationships with healthcare providers, receive consistent counseling, and become familiar with community-based services such as Posyandu. Consequently, improving the quality and continuity of ANC services may strengthen long-term engagement with the healthcare system and encourage the continued utilization of preventive child health services throughout early childhood.

Social determinants emerged as some of the strongest predictors of health service utilization. In particular, BPJS enrollment showed the strongest association with routine Posyandu attendance in the multivariable analysis. This finding suggests that financial protection remains a critical factor influencing healthcare utilization. Health insurance reduces economic barriers to accessing healthcare and increases families' willingness to seek preventive and promotive health services when needed. Previous studies have similarly demonstrated that health insurance coverage improves access to maternal and child healthcare services and reduces inequalities in healthcare utilization [35]. Access to health information was another important determinant. Families who receive health information through healthcare providers, Posyandu cadres, social media, or mass media are more likely to understand the benefits of preventive healthcare and participate in community-based health programs. Consistent with previous findings, adequate health information promotes health awareness and encourages appropriate healthcare-seeking behavior [36]. These findings are consistent with recent evidence from Indonesia showing that participation in the National Health Insurance (JKN/BPJS) program significantly increases the utilization of primary healthcare services by reducing financial barriers and improving access to essential healthcare, particularly among vulnerable populations. Similarly, individuals covered by JKN are more likely to utilize preventive healthcare services, highlighting the importance of financial protection in promoting participation in community-based health programs. Access to health information was another important determinant, as families who receive information from healthcare providers, Posyandu cadres, or mass and digital media are more likely to understand the benefits of preventive healthcare and utilize community-based health services. Adequate health information enhances health literacy and encourages appropriate healthcare-seeking behavior, enabling parents to make informed decisions regarding child growth monitoring and preventive healthcare utilization [37,38]. The strong influence of BPJS enrollment and access to health information is consistent with Andersen's Behavioral Model of Health Services Use, which identifies health insurance and health information as key enabling resources for healthcare utilization. Together, financial protection and health literacy help families overcome economic and informational barriers, thereby promoting routine participation in Posyandu and other community-based child

health services. These findings emphasize the importance of integrating universal health insurance expansion with comprehensive health promotion strategies to improve child health service utilization.

Household environmental conditions were also significantly associated with toddler health service utilization. Families living in healthier environments characterized by adequate ventilation, improved housing materials, proper waste management, absence of cigarette smoke exposure, and access to clean water were more likely to utilize Posyandu services. Environmental conditions influence both child health status and family perceptions regarding the importance of preventive healthcare. A healthy household environment is associated with lower exposure to infectious diseases and greater adoption of clean and healthy living behaviors [39]. Conversely, environmental risks such as poor sanitation, inadequate housing conditions, and exposure to cigarette smoke may increase health vulnerabilities among children and influence healthcare-seeking practices.

The multivariable analysis demonstrated that BPJS enrollment, ANC history, access to health information, waste management, exposure to cigarette smoke, and several housing-related variables remained significant predictors of toddler health service utilization after adjustment for other factors. These findings indicate that healthcare utilization is not determined by a single factor but rather by the interaction of individual, family, social, and environmental influences. The results support previous evidence that maternal and child health service utilization is shaped by a complex combination of socioeconomic resources, healthcare accessibility, health knowledge, and environmental conditions [32].

The prominent role of BPJS enrollment can be interpreted using Andersen's Behavioral Model of Health Services Use, which identifies health insurance as a key enabling factor that facilitates healthcare utilization by reducing financial barriers. In the Indonesian context, BPJS not only reduces out-of-pocket healthcare expenditures but also promotes continuity of preventive and promotive services through Posyandu and primary healthcare facilities, thereby supporting equitable access to maternal and child health services, particularly among vulnerable households. Furthermore, the regression model explained a substantial proportion of the variability in toddler health service utilization (Nagelkerke $R^2 = 0.687$), indicating that healthcare-seeking behavior is influenced by multiple interrelated determinants. Significant contributions from antenatal care history, access to health information, housing conditions, waste management, exposure to cigarette smoke, and access to clean water support the biopsychosocial and socio-ecological perspectives, which emphasize that health behavior results from the interaction of biological, behavioral, social, and environmental factors [40]. These findings highlight the need for integrated, multisectoral interventions that combine expanded BPJS coverage, strengthened maternal and child health education, improved access to reliable health information, and healthier household environments to increase routine Posyandu utilization and improve child health outcomes.

This study has several limitations. First, the cross-sectional design only allows identification of associations and does not establish causal relationships between the studied variables and toddler health service utilization. Second, the data were collected using self-reported questionnaires, which may be subject to recall bias, particularly regarding ANC history, pregnancy complications, comorbidities, and Posyandu attendance. Social desirability bias may also have influenced respondents' answers. Despite these limitations, the study's major strength lies in its comprehensive assessment of biological, psychological, social, and environmental determinants within a single analytical framework. This approach provides a broader understanding of the factors influencing Posyandu utilization and may support the development of more integrated child health policies and interventions.

CONSLUSIONS

Toddler health service utilization through Posyandu is influenced by multiple biological, psychological, social, and household environmental factors. The multivariable analysis identified paternal education, antenatal care history, parity, BPJS enrollment, access to health information, housing density, home ventilation, floor type, wall type, waste management, exposure to cigarette smoke, and access to clean water as significant determinants of Posyandu utilization. Among these factors, BPJS enrollment showed the strongest association with routine utilization of toddler health services. These findings highlight the importance of adopting a comprehensive approach that