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Maternal knowledge and family support as determinants of congenital hypothyroidism screening among pregnant women in rural area: A cross-sectional study

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Abstract:
Congenital hypothyroidism screening (CHS) prevents irreversible intellectual disability, yet its coverage in East Kalimantan, Indonesia, remains low. This study aimed to identify factors associated with CHS implementation among pregnant women in the working area of the Mendik Community Health Center, Paser Regency. An analytical cross-sectional study was conducted in September–October 2025 among 30 pregnant women recruited through total sampling. Maternal knowledge, family support, and maternal attitudes were measured using a validated questionnaire, and CHS implementation was verified through maternal and child health records and program reports. Data were analyzed using chi-square/Fisher's exact tests and multiple logistic regression. More than half of the respondents had inadequate knowledge (57%) and low family support (60%), and 53% did not implement CHS. Maternal knowledge (p = 0.009) and family support (p = 0.024) were significantly associated with CHS implementation, whereas maternal attitude was not (p = 1.000). Adequate knowledge was the dominant factor (adjusted OR = 15.40; 95% CI: 1.74–136.00), while low family support reduced the odds of screening (adjusted OR = 0.10; 95% CI: 0.01–0.83). Maternal knowledge and family support determine CHS uptake. Family-centered CHS education should be integrated into antenatal care in primary healthcare settings.

Keywords:
congenital hypothyroidism; family support; health knowledge; neonatal screening; pregnant women

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INTRODUCTION

Congenital hypothyroidism (CH) is one of the most common preventable causes of intellectual disability worldwide. Because most affected newborns look clinically normal during the first weeks of life, the condition is rarely recognized without laboratory screening, and delayed treatment can lead to permanent neurodevelopmental impairment (Rose et al., 2023; van Trotsenburg et al., 2021). Congenital hypothyroidism screening (CHS), performed through a heel-prick blood sample collected 48–72 hours after birth, allows levothyroxine therapy to start within

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the first two weeks of life. In countries with established programs, CHS has almost eliminated severe intellectual disability caused by CH (Grosse & Van Vliet, 2011; Huynh et al., 2022) and has proven highly cost-effective (Appelberg et al., 2023). For these reasons, CHS is regarded as a cornerstone of preventive child health services.

Despite these benefits, screening coverage remains uneven across low- and middle-income countries. A recent global review reported that many countries in Asia and Africa still run incomplete or fragmented newborn screening programs, limited by infrastructure, financing, and public awareness (Therrell et al., 2024). Indonesia, with approximately 4.8 million births each year, has only recently expanded CHS nationwide. A national survey of health professionals identified family refusal (39.2%) as the most frequent challenge in CHS implementation, and 96.5% of respondents perceived that parents lacked adequate understanding of the screening (Pulungan et al., 2024). Program evaluations have likewise highlighted weak public awareness, limited logistics, and poor family engagement as persistent barriers (Pulungan & Soesanti, 2020; Setyaningsih & Wulandari, 2022). The gap is particularly wide in East Kalimantan, where the 2023 Indonesian Health Survey indicated that approximately 82.5% of newborns had not undergone CHS (Ministry of Health of the Republic of Indonesia, 2023). In the working area of the Mendik Community Health Center (CHC), Paser Regency, CHS coverage in 2024 reached only about 35%, according to the CHC's annual program report.

Parental factors are central to screening uptake because the decision to screen ultimately depends on parents' understanding and consent. Studies from different settings show that mothers often hold positive attitudes toward newborn screening but have limited knowledge of its purpose, timing, and benefits (Kasem et al., 2022). Awareness tends to be higher when parents receive information from several sources and during pregnancy rather than shortly before blood sampling (Franková et al., 2019). Unclear communication and difficult interactions with screening services can further reduce parental engagement (Chudleigh et al., 2022; Conway et al., 2022). In Indonesia, knowledge and family support have been correlated with the attitudes of third-trimester pregnant women toward CHS (Retnosari et al., 2025), and health education has improved CHS knowledge among primary healthcare workers (Faizi et al., 2022). Moreover, in many Indonesian communities, health decisions are made collectively, and the involvement of husbands and extended family members shapes maternal and family health behavior (Kurniyawan et al., 2023; Yargawa & Leonardi-Bee, 2015).

Maternal knowledge, attitudes, and family support may influence screening behavior through different but complementary pathways. Knowledge enables mothers to understand the purpose, benefits, and appropriate timing of CHS, while attitudes reflect their personal evaluation of the screening procedure. However, favorable knowledge and attitudes may not necessarily lead to screening completion when mothers lack family support, practical assistance, or access to healthcare services. This distinction is consistent with the theory of planned behavior, which emphasizes the roles of attitudes, subjective norms, and perceived behavioral control in shaping behavioral intentions and actions (Ajzen, 1991). Similarly, Andersen's behavioral model highlights that individual predispositions must be accompanied by enabling resources for healthcare utilization to occur (Andersen, 1995). These perspectives suggest that understanding CHS

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implementation requires examining maternal and family-related factors together rather than considering maternal knowledge or attitudes in isolation.

However, existing Indonesian evidence has focused mainly on program evaluation, health worker training, or attitudes as the outcome, rather than on actual screening behavior. Few studies have examined whether maternal knowledge, attitudes, and family support jointly predict verified CHS implementation, and most were conducted in urban hospitals rather than in rural primary healthcare settings where coverage is lowest. Health behavior frameworks suggest that knowledge and attitudes do not always translate into action unless social and enabling factors are present (Ajzen, 1991; Andersen, 1995), but this assumption has not been tested for CHS in rural Indonesia. Identifying which modifiable factor carries the greatest weight is essential for designing efficient, family-centered education within antenatal care.

Examining actual screening implementation is particularly important because reported awareness, favorable attitudes, and intentions do not necessarily reflect completed health behaviors. In the context of CHS, mothers may understand the importance of screening and express willingness to participate, yet completion may still be affected by family decisions, communication with healthcare providers, and the availability of screening services. Previous studies have highlighted parental communication and service-related experiences as important considerations in participation in newborn screening (Chudleigh et al., 2022; Conway et al., 2022). Therefore, assessing screening implementation using documented screening records, alongside maternal and family characteristics, may provide more practical evidence for identifying barriers to CHS uptake. Such evidence is particularly relevant in rural primary healthcare settings, where improving screening coverage requires coordinated efforts between families and healthcare providers. This study aimed to identify the factors associated with the implementation of congenital hypothyroidism screening among pregnant women in the working area of the Mendik Community Health Center, Paser Regency, East Kalimantan Province, Indonesia, and to determine the dominant factor among maternal knowledge, family support, and maternal attitude.

METHODS

This study used an analytical observational design with a cross-sectional approach and was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (von Elm et al., 2007). The study was conducted between September and October 2025 in the working area of the Mendik Community Health Center, a rural primary healthcare facility in Paser Regency, East Kalimantan Province, Indonesia. This setting was selected because its CHS coverage (approximately 35% in 2024) was far below the national target.

The study population comprised third-trimester pregnant women registered for antenatal care at the Mendik CHC during the study period. A total sampling technique was applied, in which all women who met the eligibility criteria were invited to participate. The inclusion criteria were: (1) third-trimester pregnancy, (2) residence in the working area of the Mendik CHC, (3) ability to communicate effectively in Indonesian, and (4) willingness to participate and provide written informed consent. All 30 eligible women agreed to participate and were included in the analysis.

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Data were collected using a structured questionnaire developed by the researchers based on the study objectives and the literature on CHS. The questionnaire consisted of five sections: (1) sociodemographic characteristics (age, education, occupation, and parity); (2) maternal knowledge, covering the purpose, benefits, timing, procedure, and consequences of not screening; (3) family support, covering emotional, informational, motivational, and approval dimensions; (4) maternal attitudes, reflecting perceptions and acceptance of CHS; and (5) CHS implementation. Items in sections 2–4 were rated on a 5-point Likert scale, and total scores were dichotomized as adequate or inadequate knowledge, high or low family support, and positive or negative attitude based on the predetermined cut-off scores of the instrument. Before data collection, the questionnaire was tested for validity and reliability. All items were valid, as indicated by corrected item–total correlation coefficients greater than the critical r-table value, and Cronbach's alpha exceeded 0.70, indicating acceptable internal consistency.

The dependent variable was CHS implementation, defined as the mother bringing her newborn to a healthcare facility for heel-prick blood sampling according to the recommended schedule (48–72 hours after birth) and procedure. Screening status was verified through observation, the Maternal and Child Health (KIA) handbook, and CHC program records, and was categorized as "implemented" or "not implemented." Data were collected directly by the researchers at the Mendik CHC. The purpose and procedures of the study were explained to each participant before the questionnaire was completed, and every questionnaire was checked for completeness immediately after collection.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Categorical variables were summarized as frequencies and percentages. Associations between each independent variable and CHS implementation were examined using Pearson's chi-square test. Because of the small sample size, Fisher's exact test p-values are reported for all 2×2 tables, together with crude odds ratios (ORs) and 95% confidence intervals (CIs). Variables with $p < 0.05$ in the bivariate analysis were entered into a multiple logistic regression model to identify the dominant factor, and the results are presented as adjusted ORs with 95% CIs. Model performance was described using the Nagelkerke R^2. Statistical significance was set at $p < 0.05$ (two-tailed).

The study was approved by the Health Research Ethics Committee (approval number 021/09.KEPK/UBK/XII/2025) and was conducted in accordance with the Declaration of Helsinki. All participants received verbal and written information about the study and provided written informed consent. Participation was voluntary; participants could withdraw at any time without consequences for their care, and all data were anonymized and stored confidentially.

RESULTS

A total of 30 pregnant women participated in this study. Participants' sociodemographic characteristics, knowledge, family support, and attitudes toward congenital hypothyroidism screening (CHS) are presented in Table 1. Most participants were aged 26–30 years (37%), had completed senior high school (47%), and were housewives (70%). Primiparous and multiparous women each accounted for 40% of the sample, while grand multiparous women accounted for 20%. More than half of the respondents had inadequate knowledge of CHS (57%), and 60%

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reported low family support. Maternal attitudes were evenly distributed, with 50% positive and 50% negative.

Table 1. Distribution of Respondents According to Sociodemographic Characteristics, Knowledge, Family Support, and Maternal Attitudes Toward Congenital Hypothyroidism Screening (CHS)

Variables	Categories	Frequency (n)	Percentage (%)
Age (years)	21–25	9	30
	26–30	11	37
	31–35	6	20
	36–40	4	13
Educational Level	Higher education	5	17
	Senior high school	14	47
	Junior high school	9	30
	Elementary school	2	7
Occupation	Civil servant	4	13
	Self-employed	2	7
	Farmer	3	10
	Housewife	21	70
Parity	Primipara	12	40
	Multipara	12	40
	Grand multipara	6	20
Maternal Knowledge	Inadequate	17	57
	Adequate	13	43
Family Support	High	12	40
	Low	18	60
Maternal Attitude	Negative	15	50
	Positive	15	50

Table 2. Distribution of Congenital Hypothyroidism Screening Implementation Among Respondents

Variable	Category	Frequency	Percentage
Implementation of Congenital Hypothyroidism Screening	Not implemented	16	53
	Implemented	14	47

CHS implementation among respondents remained low. Of the 30 participants, 16 (53%) did not have their newborns screened, whereas only 14 (47%) completed screening according to the recommended procedure and schedule (Table 2).

Table 3. Cross-Tabulation of Maternal Knowledge, Family Support, and Maternal Attitude by Implementation of Congenital Hypothyroidism Screening (n = 30)

Variables	Categories	Implemented n (%)	Not implemented n (%)	Total n (%)	p-value*
Maternal knowledge	Adequate	10 (76.9)	3 (23.1)	13 (100)	0.009
	Inadequate	4 (23.5)	13 (76.5)	17 (100)	
Family support	High	9 (75.0)	3 (25.0)	12 (100)	0.024
	Low	5 (27.8)	13 (72.2)	18 (100)	
Maternal attitude	Positive	7 (46.7)	8 (53.3)	15 (100)	1.000
	Negative	7 (46.7)	8 (53.3)	15 (100)	

*Fisher's exact test; percentages are row percentages.

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Table 3 presents the distribution of CHS implementation according to maternal knowledge, family support, and attitude. Screening completion was higher among mothers with adequate knowledge (76.9%) than among those with inadequate knowledge (23.5%). Similarly, screening completion was more frequent among mothers with high family support (75.0%) than among those with low family support (27.8%). In contrast, the proportion of completed screening was identical among mothers with positive and negative attitudes (46.7% in each group).

Table 4. Bivariate Analysis of Factors Associated with the Implementation of Congenital Hypothyroidism Screening

Variables (comparison)	χ^2 (df = 1)	p-value*	OR (95% CI)	Interpretation
Maternal knowledge (adequate vs. inadequate)	8.44	0.009	10.83 (1.96–59.84)	Significant
Family support (high vs. low)	6.45	0.024	7.80 (1.48–41.22)	Significant
Maternal attitude (positive vs. negative)	0.00	1.000	1.00 (0.24–4.20)	Not significant

*Fisher's exact test. OR = odds ratio; CI = confidence interval. Outcome: CHS implemented.

Bivariate analysis (Table 4) showed significant associations between CHS implementation and maternal knowledge (p = 0.009) and family support (p = 0.024). Mothers with adequate knowledge had higher odds of completing screening than those with inadequate knowledge (crude OR = 10.83; 95% CI: 1.96–59.84). Likewise, mothers with high family support had higher odds of screening completion than those with low family support (crude OR = 7.80; 95% CI: 1.48–41.22). Maternal attitude was not significantly associated with screening implementation (p = 1.000; OR = 1.00; 95% CI: 0.24–4.20).

Table 5. Multiple Logistic Regression Analysis of Factors Associated with the Implementation of Congenital Hypothyroidism Screening

Variables	Categories	Adjusted OR	95% CI	p-value
Maternal knowledge	Inadequate (ref.)	1.00	–	–
	Adequate	15.40	1.74–136.00	0.014
Family support	High (ref.)	1.00	–	–
	Low	0.10	0.01–0.83	0.033

OR = odds ratio; CI = confidence interval; ref. = reference category. Outcome: CHS implemented. Nagelkerke R^2 = 0.52.

In the multivariable logistic regression model (Table 5), maternal knowledge and family support remained independently associated with CHS implementation. After adjustment for family support, mothers with adequate knowledge had higher odds of completing screening than those with inadequate knowledge (adjusted OR = 15.40; 95% CI: 1.74–136.00; p = 0.014). Conversely, low family support was associated with lower odds of screening completion compared with high family support (adjusted OR = 0.10; 95% CI: 0.01–0.83; p = 0.033). The Nagelkerke R^2 value of 0.52 indicates that the model accounted for approximately 52% of the variation in CHS implementation.

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DISCUSSION

This study found that CHS implementation in a rural primary healthcare setting in East Kalimantan remained low, with more than half of the newborns of participating women not screened. Maternal knowledge and family support were significantly associated with CHS implementation, whereas maternal attitude was not. After adjustment, maternal knowledge emerged as the dominant factor: mothers with adequate knowledge had about 15 times higher odds of having their newborns screened, and mothers with low family support had about 90% lower odds. Together, these two factors explained about half of the variation in screening behavior. In simple terms, what mothers know and who supports them appear to matter more than how they feel about screening.

The low screening rate (47%) is consistent with national and regional reports. Indonesia is still in the early phase of nationwide CHS expansion, and coverage in East Kalimantan has been among the lowest in the country (Ministry of Health of the Republic of Indonesia, 2023). Globally, low- and middle-income countries in Asia face similar gaps, often because screening relies on parental consent in programs that are still building awareness and infrastructure (Therrell et al., 2024). In Indonesia, health professionals identified family refusal as the main obstacle to screening and believed that almost all parents lacked adequate understanding of CHS (Pulungan et al., 2024). By using verified screening records rather than provider perceptions, the present study provides community-level evidence supporting this view.

Maternal knowledge was the strongest predictor of CHS implementation. This finding can be explained by the nature of congenital hypothyroidism itself. Most affected infants look healthy at birth, so parents who do not understand the purpose of screening may see no reason to bring an apparently well baby for a blood test (Rose et al., 2023; van Trotsenburg et al., 2021). Knowledge helps mothers recognize screening as a preventive step rather than a response to illness. This reflects the concept of health literacy, in which people need not only information but also the ability to understand it and act on it (Nutbeam, 2008). Our results agree with studies in Jordan and the Czech Republic showing that mothers' knowledge of newborn screening was often limited, even when their attitudes were positive, and that awareness was higher among mothers who received information from several sources and during pregnancy (Franková et al., 2019; Kasem et al., 2022). In Indonesia, Retnosari et al. (2025) also reported that a considerable proportion of third-trimester pregnant women had poor knowledge of CHS. The wide confidence interval of the adjusted odds ratio reflects the small sample and indicates that the true effect may be smaller than estimated; nevertheless, the direction and strength of the association were consistent in both the bivariate and multivariable analyses.

Family support was the second significant factor. In Indonesia, decisions about maternal and newborn care are often made together with husbands, parents, and in-laws, particularly in rural communities. A mother who wants her baby screened may still delay or cancel the visit if her family does not consider screening necessary or does not provide permission, transport, or practical help after delivery. This interpretation is supported by evidence that male involvement improves the use of maternal health services (Yargawa & Leonardi-Bee, 2015) and by studies among farming families in Indonesia showing that family support strengthens health awareness and healthy behavior at

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home (Kurniyawan et al., 2023, 2024). Retnosari et al. (2025) similarly found that family support was positively related to pregnant women's attitudes toward CHS. The present study extends these findings by showing that family support is linked not only to attitudes but also to actual screening behavior. Involving family members should therefore be treated as a central component, rather than an optional addition, of CHS promotion.

The findings also suggest that maternal knowledge and family support should be understood as complementary factors in the decision to undertake CHS. Knowledge provides mothers with the understanding needed to recognize the importance of screening, whereas family support may provide the social approval and practical resources required to translate that understanding into action. This interpretation is consistent with the theory of planned behavior, which recognizes the roles of perceived social norms and behavioral control in shaping health-related actions (Ajzen, 1991). It also reflects Andersen's behavioral model, in which individual predispositions alone may be insufficient without enabling resources and access to healthcare services (Andersen, 1995). Therefore, CHS promotion should not rely solely on improving maternal knowledge but should also address the family and practical circumstances surrounding newborn screening.

Interestingly, maternal attitude was not associated with CHS implementation; screening rates were identical among mothers with positive and negative attitudes. This finding illustrates the well-known gap between attitudes or intentions and actual behavior (Sheeran, 2002). According to the theory of planned behavior, attitudes lead to action only when people also perceive social support and behavioral control (Ajzen, 1991). Likewise, Andersen's behavioral model emphasizes that enabling factors, such as family resources and access to services, determine whether a favorable predisposition is translated into service use (Andersen, 1995). A mother may agree that screening is good, but without knowing when and where to go, and without family backing, a positive attitude alone is not enough. Practical problems that parents experience within screening systems, such as unclear communication and difficulty navigating services, may further weaken the link between attitude and action (Conway et al., 2022). The balanced distribution of attitudes and the small sample may also have limited the power to detect a weaker association.

The regression model explained about half of the variation in screening behavior, indicating that other factors also play a role. Health system barriers reported in Indonesia include the discharge of newborns within 24 hours of birth, limited supply of filter paper, and insufficient training for health workers (Pulungan et al., 2024). Delivery outside health facilities, travel distance, and indirect costs may also prevent screening in rural areas (Pulungan & Soesanti, 2020; Setyaningsih & Wulandari, 2022). These factors were not measured in the present study and should be considered in future research.

These findings have clear implications for nursing and midwifery practice in primary healthcare. First, CHS education should be integrated into routine antenatal care, especially during the third trimester, so that mothers understand the purpose, timing, and procedure of screening before delivery. Information provided only after birth, when mothers are tired and discharge is rapid, may come too late (Franková et al., 2019). Second, education should be family-centered, inviting husbands and other key decision-makers to pregnancy classes (kelas ibu hamil), integrated health post (Posyandu) sessions, and home visits. Third, simple tools such as reminders in the KIA handbook, leaflets, and short text messages before the expected delivery date may help families

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remember the 48–72-hour screening window. Finally, health workers need adequate training, because structured education has been shown to improve their CHS knowledge (Faizi et al., 2022), and co-designed communication with parents can improve the understanding of screening results (Chudleigh et al., 2022). Community nursing approaches that work through families, as applied in rural farming communities (Kurniyawan et al., 2024), offer a practical model for implementing this strategy.

Another important consideration is ensuring continuity between antenatal education, delivery services, and postnatal follow-up. Providing information during pregnancy will have limited impact if families encounter difficulties accessing screening after birth or if healthcare workers do not provide clear instructions regarding the screening schedule. Coordination between midwives, nurses, community health workers, and referral facilities is therefore essential to ensure that eligible newborns are identified, screened within the recommended period, and followed up when results require further evaluation. Addressing health-system constraints, including staff training, screening supplies, and communication with parents, may strengthen the effectiveness of family-centered education (Pulungan et al., 2024; Faizi et al., 2022; Chudleigh et al., 2022). This integrated approach may help bridge the gap between maternal awareness and the actual completion of CHS in rural primary healthcare settings.

This study has several limitations. First, the sample was small and drawn from a single CHC, which limits generalizability and statistical precision. With only 14 screened newborns, the number of events per variable in the regression model was below the commonly recommended threshold, which may produce unstable estimates and wide confidence intervals (Peduzzi et al., 1996). Second, the cross-sectional design does not allow causal conclusions. Third, knowledge, attitude, and family support were self-reported and dichotomized, which may introduce reporting bias and information loss. Fourth, potentially important factors such as household income, distance to services, place of delivery, and health worker support were not analyzed. Despite these limitations, the use of verified screening records and the focus on an underserved rural setting are strengths of this study. Future studies should use larger, multicenter samples, longitudinal designs, and intervention trials testing family-centered antenatal education to improve CHS uptake.

CONCLUSION

This study found that CHS implementation in the working area of the Mendik Community Health Center remained low, with fewer than half of the participants' newborns screened. Maternal knowledge and family support were significantly associated with CHS implementation, with maternal knowledge being the dominant factor, whereas maternal attitude showed no association. Strengthening CHS education during antenatal care and actively involving husbands and family members through pregnancy classes and Posyandu activities are recommended to improve screening coverage in rural primary healthcare settings.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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