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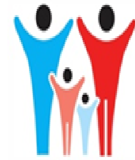

Determinants of Gynecological Ultrasound Utilization Among Pregnant Women: Evidence from Indonesia's National Health Insurance Claims

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Abstract

Background: Equitable access to prenatal ultrasound (USG) is critical for improving maternal health outcomes in Indonesia. Although hospital-based USG is covered under the national health insurance scheme (JKN), utilization may vary across demographic and socioeconomic groups. **Objective**: To examine how maternal age, place of residence, geographic region, and insurance membership segment are associated with hospital-based USG use among pregnant women covered by JKN. **Methods**: This cross-sectional study analyzed the 2023 maternal health dataset from *BPJS Kesehatan (Healthcare)*. Of 468,922 pregnant women, 13,787 with at least one hospital-based ultrasound visit (INA-CBG code Z-3-25-0) were included. Descriptive statistics and negative binomial regression assessed associations with age, domicile, region, insurance segment, and ward class. **Results**: Among 13,787 women with hospital-based ultrasound visits, the average utilization was two scans per year. In Model 1, regency residents had lower utilization than city residents (IRR = 0.90, 95% CI: −0.11 to −0.10), while women in Java–Bali showed slightly higher use (IRR = 1.06, 95% CI: 0.04–0.07). Utilization was lower in Sumatra (IRR = 0.89), Sulawesi (IRR = 0.84), and Kalimantan (IRR = 0.97). Compared with formal workers, lower rates were observed among subsidized groups such as PBI-APBN (IRR = 0.89), PBI-APBD (IRR = 0.90), and non-workers (IRR = 0.84). Age was positively associated with higher use (IRR = 1.01 per year). In Model 2, interaction terms revealed regional variations: for instance, disparities by insurance segment were most pronounced in Java, Sulawesi, and Kalimantan, with IRRs ranging from 0.60 to 1.09. Overall, while statistically significant, the effect sizes remained modest. **Conclusion**: Although in-hospital USG services under JKN are guided by clinical indications, geographic and insurance-related disparities persist. These patterns suggest the influence of structural and access-related factors, highlighting the need to strengthen equitable referral and service delivery across regions.

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INTRODUCTION

Ultrasound imaging (USG) is a fundamental component of modern prenatal care, offering essential diagnostic information for monitoring fetal development, confirming gestational age, identifying multiple pregnancies, and detecting major fetal anomalies. When performed before 24 weeks of gestation, ultrasound can accurately date pregnancies and guide further clinical decision-making.[1] Even in the era of non-invasive prenatal testing (NIPT), first-trimester ultrasound remains indispensable for structural assessments that cannot be detected by genetic screening alone.[2]

Beyond its role in early pregnancy, ultrasound remains essential in later stages for assessing fetal growth, detecting potential complications, and guiding perinatal care, even in pregnancies without known risk factors.[3] It also enables the early detection of women at risk for preterm birth or other adverse outcomes, allowing for timely clinical response.[4]

The emotional benefits of ultrasound, including its ability to foster maternal–fetal attachment and provide reassurance, are well documented.[5,6] However, its use should be guided by clinical indications. Unnecessary use without medical justification may strain health system capacity and divert attention from other critical antenatal services.[7]

Globally, utilization of prenatal ultrasound (USG) shows considerable variation. In Ethiopia, only 62.8% of pregnant women in public hospitals received at least one ultrasound, falling short of WHO recommendations.[8,9] In Latvia, the median number of scans per pregnancy was three to four, with regional differences.[10] In Canada, 87.7% of pregnancies had a second-trimester scan, with higher use in urban and wealthier groups.[11] During the COVID-19 pandemic, US hospitals maintained stable utilization despite care disruptions.[12,13]

In Indonesia, ultrasound services are theoretically available to all pregnant women through National Health Insurance (JKN), the national health insurance scheme and one of the world's largest single-payer systems.[14,15] Managed by *BPJS Healthcare*, JKN has expanded coverage nationwide and improved financial protection for vulnerable populations.[16,17] However, its full potential to promote preventive care has yet to be realized. Essential primary care services such as antenatal education and healthy pregnancy monitoring remain underutilized.[18]

Although covered under JKN, hospital-based ultrasound services are typically accessed only when clinically indicated, usually following referral from primary care (FKTP) and requiring

confirmation by obstetricians or specialists,[19 20] In this gatekeeping system, USG utilization at the hospital level reflects diagnostic rather than routine screening purposes. However, disparities in access to ultrasound equipment and trained healthcare providers persist, particularly in rural and remote regions, limiting timely detection and referral.[21 22] As a result, despite JKN's comprehensive maternal health coverage, access to hospital-based USG remains uneven across Indonesia, shaped by demographic, socioeconomic, and regional differences.[23–25]

Previous studies have shown that factors such as maternal education, household income, and urban residence are consistently associated with higher ultrasound utilization, while women in rural or remote areas face persistent barriers regarding access.[8,9,11] A history of pregnancy complications has also been linked to more frequent scans, whereas institutional constraints like limited equipment and staffing reduce utilization rates in resource-limited settings.[26]

[23]Although the Ministry of Health is gradually equipping community health centres (*Puskesmas*) with ultrasound devices, available evidence remains largely descriptive and focused on service availability rather than actual utilization.[21] Previous studies in various countries have shown that ultrasound utilization is shaped by sociodemographic factors (such as residence, education, and income), maternal health conditions, and institutional availability of services. However, little is known about how these factors operate in the Indonesian context under a universal insurance system like JKN, where hospital-based ultrasounds are typically accessed via referral for diagnostic rather than routine purposes. This study adds new evidence by analyzing national claims data to assess demographic, regional, and insurance-related determinants of hospital-based ultrasound utilization in Indonesia.

METHODS

Study Design and Data Source

This study was cross-sectional observational design using secondary data from the contextual maternal and child health or *kesehatan ibu dan anak* (KIA) sample dataset provided by the Social Health Insurance Administration Body (*BPJS Healthcare*). The dataset includes information on pregnant women who received maternity-related services and the records of their health service utilization, including hospital-level care (FKRTL). The data could be accessed from data.bpjs-kesehatan.go.id. For this study, we focused exclusively on outpatient visits in hospitals occurring between January 1 and December 31, 2023. It is important to note that the number of ultrasound visits reflects services accessed within the 2023 calendar year only and may not represent the full sequence of ultrasounds across a woman's entire pregnancy.

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In accordance with Indonesia National Research and Innovation Agency (BRIN), research using anonymized secondary claims data does not require formal ethical clearance, as confirmed by a Letter of Notification issued by the BRIN Ethics Committee Secretariat on September 2, 2025.

Sample Study and Data Cleaning Process

From a total of 468,922 pregnant women identified in the KIA dataset (2017–2023), we restricted our analysis to those who accessed hospital-based specialist outpatient services in 2023. This yielded a subset of 37,878 pregnant women who had at least one specialist outpatient visit recorded in that year. Among them, we identified 13,787 women who received gynecologic ultrasound services during their hospital visit, as indicated by the INA-CBG procedure code Z-3-25-0, recorded in the FKL19 variable. These 13,787 pregnant women were the final sample in this study.

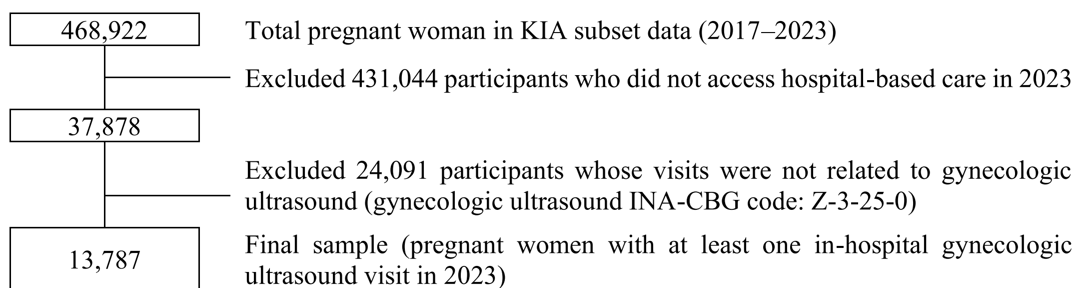

Figure 1. Sample Cleaning Process

Variables and Measures

The primary outcome variable was the number of ultrasound visits per individual in 2023, as recorded in the utilization/number of visits variable. Explanatory variables were derived from the participant and service datasets and included: (1) age: participant's age at the date of last visit in 2023; (2) residency location (district-level, city or regency); (3) regional: broader region of residence categorized into: Java, Sumatra, Bali–Nusa Tenggara, Sulawesi, and Papua–Maluku; (4) segmentation: participant's insurance segment, categorized as non-worker (PBPU), formally employed (PPU), or subsidized (PBI). All variables were numeric-coded categorical or continuous, as defined in the dataset's data dictionary. The unique participant ID was represented by the PSTV01 variable.

Statistical Analysis

Descriptive statistics were conducted to summarize participant characteristics and ultrasound utilization. This included the distribution of categorical variables such as membership segment, and region, as well as continuous variables such as age of the pregnant women and number of ultrasound visits. The number of ultrasound visits in 2023 (utilization count) was treated as the dependent variable.

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To assess whether the utilization variable met the assumptions for parametric analysis, a Kolmogorov–Smirnov test was performed. The result indicated that the distribution of the ultrasound visit count was not normally distributed ($p < 0.001$), supporting the need for a non-parametric modeling approach.

Given that the dependent variable was a count outcome (number of ultrasound visits) and exhibited non-normal distribution and overdispersion (variance greater than the mean), a Generalized Linear Model (GLM) with a negative binomial distribution and a log link function was employed. GLMs are appropriate when the assumptions of traditional linear regression, such as normality, homoscedasticity, and linearity, are not met [27].

The model included the following independent variables: age, region of residence, domicile type (urban/rural), and insurance membership segment, ward class premium contribution. Results were presented as incidence rate ratios (IRRs) with 95% confidence intervals. A negative binomial regression model with a log link was specified as:

$$\log(\mu_i) = \beta_0 + \beta_1(Age) + \beta_2(Region) + \beta_3(Domicile) + \beta_4(JKN\ membership\ segment) + \epsilon_i$$

Note:

1. μ_i represents the expected number of ultrasound visits for individual i,
2. β_0 is the intercept,
3. β_1 to β_5 are regression coefficients for each covariate,
4. and ϵ_i is the error term.

RESULTS

This study examined the characteristics of 13,787 pregnant women who accessed outpatient ultrasound (USG) services at secondary healthcare facilities (FKRTL) in Indonesia throughout 2023. Sample characteristics of this study can be seen in Table 1.

Table 1. Sample Characteristics (n = 13,787)

Variable		n	%
Ultrasound Utilization (number of visits in 2023)	Mean	2	–
	Median	1	–
	Maximum	15	–
	Minimum	1	–
	Standard Deviation	1	–
Age (at last visit)	Mean	29	–
	Median	29	–
	Maximum	51	–
	Minimum	12	–
	Standard Deviation	6	–
Place of Residence (Domicile)	Regency (Kabupaten)	8,643	62,7,
	City (Kota)	5,144	37,3,
Geographic Region	Nusa Tenggara, Maluku, Papua	1,240	9,0,
	Java and Bali	6,703	48,6,
	Sumatra	2,950	21,4,
	Kalimantan	1,350	9,8,
	Sulawesi	1,544	11,2,
Participant Segment	Non worker	13	0,1,
	PBI – National Budget (APBN)	4,560	33,1,

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Variable		n	%
	PBI – Regional Budget (APBD)	2,455	17,8,
	PBPU – Informal Worker	2,338	17,0,
	PPU – Formal Worker	4,421	32,1,

Source : BPJS Healthcare, processed by authors.

On average, each participant underwent 2 ultrasound visits during the year, with a median of 1 visit (range: 1–15). The mean age at the time of their last visit was 29 years (SD = 6), with ages ranging from 12 to 51 years. Most participants resided in regency areas (62.7%), while the remainder lived in urban cities (37.3%). Regionally, nearly half were from Java and Bali (48.6%), followed by Sumatra (21.4%), Sulawesi (11.2%), and Nusa Tenggara, Maluku, and Papua (9.0%). In terms of insurance segmentation, the largest proportion were participants subsidized by the central government (PBI APBN, 33.1%), followed by formal workers (PPU, 32.1%), regional subsidies (PBI APBD, 17.8%), and informal workers (PBPU, 17.0%), with a negligible proportion categorized as unemployed (0.1%).

Table 2. Determinant of USG Utilization

Predictor	Model 1			Model 2		
	IRR	95% CI	p-value	IRR	95% CI	p-value
Domicile (Ref: city)						
regency	0.90	(-0.11)–(-0.10)	0.00*	0.90	(-0.11)-(-0.09)	0.00*
Region (Ref: NTT–Maluku–Papua)				Ref		
Java dan Bali	1.06	(0.04)–(0.07)	0.00*	1.06	0.03-0.08	0.00*
Sumatra	0.89	(-0.12)–(-0.09)	0.00*	0.87	(-0.16)-(-0.11)	0.00*
Kalimantan	0.97	(-0.04)–(-0.01)	0.00*	0.97	(-0.06)-0	0.05
Sulawesi	0.84	(-0.19)–(-0.16)	0.00*	0.83	(-0.22)-(-0.15)	0.00*
Insurance Segment (Ref: PPU/ formal worker)				Ref		
Non Worker	0.84	(-0.27)–(-0.06)	0.00*	1.06	(-0.27)-(0.39)	0.72
PBI APBN	0.89	(-0.13)–(-0.11)	0.00*	0.86	(-0.18)-(-0.12)	0.00*
PBI APBD	0.90	(-0.11)–(-0.10)	0.00*	0.84	(-0.21)-(-0.13)	0.00*
PBPU	0.95	(-0.06)–(-0.05)	0.00*	1.09	0.04-0.13	0.00*
Age (continuous)	1.01	0.01–0.01	0.00*	1.01	0.01-0.01	0.00*
Interaction Terms						
Java and Bali * PPU				Ref		
Java and Bali * Non Worker				0.75	(-0.65)-(0.06)	0.00*
Java and Bali * PBI APBN				1.02	(-0.01)-0.05	0.11
Java and Bali * PBI APBD				1.08	0.04-0.12	0.3
Java and Bali * PBPU				0.85	(-0.21)-(-0.12)	0.00*
Sumatra * PPU				Ref		
Sumatra * Non Worker				1.07	(-0.48)-0.61	0.81
Sumatra * PBI APBN				1.07	0.04-0.11	0.00*
Sumatra * PBI APBD				1.04	(-0.01)-0.08	0.11
Sumatra * PBPU				0.92	(-0.13)-(-0.03)	0.00*
Kalimantan * PPU				Ref		
Kalimantan * Non Worker				1.77	(-0.15)-1.28	0.12
Kalimantan * PBI APBN				0.99	(-0.05)-0.03	0.53

Predictor	Model 1			Model 2		
	IRR	95% CI	p-value	IRR	95% CI	p-value
Kalimantan * PBI APBD				1.06	0.01-0.11	0.01
Kalimantan * PBPU				0.89	(-0.17)-(-0.06)	0.00*
Sulawesi * PPU				0[a]		
Sulawesi * Non Worker				0.60	(-0.98)-(-0.04)	0.03
Sulawesi * PBI APBN				1.06	0.02-0.1	0.00*
Sulawesi * PBI APBD				1.06	0.01-0.11	0.02
Sulawesi * PBPU				0.84	(-0.23)-(-0.12)	0.00*
Nusa Tenggara, Maluku and Papua * Non Worker				0[a]		
Nusa Tenggara, Maluku and Papua * PBI APBN				0[a]		
Nusa Tenggara, Maluku and Papua * PBI APBD				0[a]		
Nusa Tenggara, Maluku and Papua * PBPU				0[a]		
Nusa Tenggara, Maluku and Papua * PPU				0[a]		

Note:

1. The model includes interaction terms between geographic region and insurance segment.
2. Reference groups are:
   a. Region: Nusa Tenggara, Maluku, and Papua
   b. Insurance segment: PPU (formal workers)
3. IRR compared to the reference category:
   a. values >1 indicate higher utilization
   b. values <1 indicate lower utilization.
4. Parameters marked as 0[a] are redundant due to the reference group coding and were omitted from estimation.
5. IRR : Incidence Rate Ratio.
6. CI : Confidence Interval.
7. * : statistical significance at $p < 0.05$.

The regression analysis examined the association between sociodemographic characteristics and the number of hospital-based ultrasound visits among pregnant women in 2023. The model showed that residence, geographic region, insurance membership segment, and age were all significantly associated with utilization ($p < 0.001$).

Compared to women living in cities (reference group), those residing in rural or regency (kabupaten) areas had lower utilization (IRR 0.90). For geographic region, women in Java and Bali had slightly higher utilization (IRR 1.06), while those in Sumatra (IRR 0.89), Kalimantan (IRR 0.97), and Sulawesi (IRR 0.84) had lower rates compared to the reference group, which was Nusa Tenggara, Maluku, and Papua. In terms of insurance segment, formal workers (PPU) served as the reference category. Compared to them, non-workers (IRR 0.84), PBI APBN (IRR 0.89), PBI APBD (IRR 0.90), and PBPU (IRR 0.95) all had lower ultrasound utilization. The lowest usage was observed among non-workers. The women's age was positively associated with utilization. Each additional year of age was associated with a 1% increase in the expected number of ultrasound visits (IRR 1.01).

In Model 2, interaction terms between geographic region and insurance membership segment were added to explore whether the effect of insurance type varied by location. The main effects for

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domicile and geographic region remained consistent with Model 1. Women living in regency areas continued to exhibit lower utilization compared to those in cities (IRR 0.90. Similarly, women in Java and Bali had higher utilization (IRR 1.06), while those in Sumatra (IRR 0.87), Kalimantan (IRR 0.97), and Sulawesi (IRR 0.83) continued to have lower rates compared to the eastern region. However, differences were observed in the insurance segment. While non-workers had significantly lower utilization in Model 1 (IRR 0.84), this association was no longer statistically significant in Model 2 (IRR 1.06, p = 0.72). This finding suggests that the influence of this group is modified by regional context. A similar shift was observed among informal workers (PBPU), whose utilization increased from IRR 0.95 in Model 1 to IRR 1.09 in Model 2. These differences highlight the importance of accounting for interaction effects, particularly when investigating how insurance coverage interacts with geographic disparities. The effect of women's age remained stable across both models, with each additional year associated with a 1% increase in ultrasound use (IRR 1.01).

The inclusion of interaction terms between region and insurance segment in Model 2 revealed nuanced patterns in utilization. In Java and Bali, non-workers had substantially lower utilization compared to formal workers (PPU), with an IRR of 0.75, while informal workers (PBPU) also showed reduced use (IRR 0.85). Conversely, PBI APBN and APBD groups in this region exhibited similar or slightly higher utilization, although not all estimates reached significance. In Sumatra, informal workers (PBPU) had lower utilization (IRR 0.92), while PBI APBN recipients had a modest increase (IRR 1.07). In Kalimantan, the interaction with PBI APBD was associated with increased utilization (IRR 1.06), whereas PBPU participants had reduced rates (IRR 0.89). In Sulawesi, non-workers and PBPU members had significantly lower utilization (IRR 0.60 and 0.84, respectively), while PBI APBN and APBD participants experienced higher use (both IRR 1.06). In contrast, the eastern region (Nusa Tenggara, Maluku, and Papua) served as the reference group for all interactions, and therefore their IRRs were not estimated separately in the model. These patterns indicate that the effect of insurance membership segment on ultrasound utilization is not uniform across regions, with particularly pronounced disparities in Java, Sulawesi, and Kalimantan.

DISCUSSION

This study found that both individual and contextual factors were significantly associated with the number of outpatient ultrasound (USG) utilizations among insured pregnant women in 2023. Key predictors included age, type of residence, geographic region, insurance segment, and their interactions. Although these associations were statistically significant, the effect sizes were generally modest. Most IRRs among significant predictors ranged between 0.83 and 1.09, reflecting only small increases or decreases in utilization relative to the reference categories. These findings indicate that structural and demographic disparities in access exist, but their influence on overall USG utilization

frequency appears limited. This suggests that other unmeasured factors, such as health literacy, cultural beliefs, or provider-side dynamics, may also contribute to variations in service use.

Our analysis found that pregnant women residing in districts (kabupaten) were significantly less likely to utilize in-hospital USG services compared to those living in cities, as indicated by an IRR of 0.90. This finding is consistent with previous research showing that urban residents tend to have better access to health services, including prenatal diagnostics, due to the higher availability of hospitals, ultrasound equipment, and trained healthcare providers.[26,28] Conversely, rural and district areas often face infrastructural and geographic barriers that limit access to such services.[29–31] While the direction of this disparity may seem predictable, this study contributes by empirically quantifying the magnitude of inequality using a nationally representative dataset of insured pregnant women. The relatively modest IRR values provide a more precise understanding of the extent of disparity, which had not been reported before on this scale. Furthermore, by introducing interaction terms between region and insurance segment, this study highlights that inequalities are not uniformly distributed. For instance, the disadvantage experienced by women in certain insurance categories, such as non-workers or PBPU, is more pronounced in some regions than others.

Compared to pregnant women residing in Nusa Tenggara, Maluku, and Papua (the reference group), those in Java and Bali had slightly higher utilization (IRR: 1.06), while those in Sumatra, Kalimantan, and Sulawesi showed significantly lower IRRs, particularly in Sulawesi (IRR: 0.83). Although such regional disparities are broadly acknowledged, the added value of this study lies in quantifying these differences using administrative claims data under a national health insurance scheme. Previous research has primarily focused on service availability or access challenges without providing effect size estimates from population-level data.[26,32] By demonstrating the relative gaps across regions within the same insurance framework, our analysis underscores that geographic inequalities persist even under a UHC system intended to offer uniform coverage. This highlights a need to revisit how JKN resources and referral mechanisms are implemented across regions to avoid unintended disparities in care provision.[23,24]

Disparities in ultrasound utilization across insurance segments were evident, with non-workers and government-subsidized members (PBI) showing lower utilization rates than formal employees (PPU). While prior studies have broadly linked lower socioeconomic status to reduced access in maternal care, this study adds nuance by identifying differential patterns even within subsidized groups. The PBI-APBD segment group had slightly lower utilization than PBI-APBN, and both were lower than formal workers.[33] This distinction has not been emphasized in earlier literature and highlights how variations in policy implementation between central and regional governments may translate into unequal service access. Furthermore, the finding that non-workers had the lowest rate of utilization raises concerns, as this group may fall outside conventional targeting frameworks in

maternal health interventions. These results suggest that despite JKN's universal coverage, structural disparities persist and are patterned not only by socioeconomic status but also by membership classification within the insurance system.

The interaction analysis reveals that disparities in ultrasound utilization are shaped by a combination of geographic and insurance-related factors, rather than by each factor alone. For example, non-worker members in Sulawesi had substantially lower utilization, while their counterparts in Kalimantan showed relatively higher access despite similar insurance status. Likewise, PBPU members in Java fared better than those in Sumatra or Sulawesi. These findings indicated even in universal health systems, women in rural or remote areas have significantly lower ultrasound utilization due to long travel distances, fewer facilities, and limited availability of trained providers and equipment[33–36] Lower socioeconomic status, minority background, and limited knowledge about ultrasound benefits also contribute to underuse, indicating that financial coverage alone does not fully address disparities in access.[11]

To address disparities in hospital-based ultrasound utilization, especially among disadvantaged groups in rural and remote regions, the Ministry of Health and *BPJS Kesehatan* should prioritize expanding point-of-care ultrasound services at primary care facilities. This includes training midwives or nurses to perform basic scans, deploying portable ultrasound devices, and integrating tele-ultrasound systems where remote specialists interpret images acquired locally. These approaches have shown success in increasing access and reducing delays in countries like Nepal, Peru, and rural Australia, particularly when accompanied by ongoing training, equipment support, and reliable digital infrastructure.[29,30,32,37]

The disparities observed in hospital-based ultrasound utilization can be explained by a combination of geographic, socioeconomic, and clinical factors. Women living in rural or district areas face limited access to ultrasound services due to infrastructural gaps, long travel distances, and fewer trained providers, which reduce their likelihood of receiving timely scans compared to urban residents.[29] Regional differences further exacerbate these inequalities: while Java and Bali benefit from higher facility density and concentration of specialists, areas such as Sumatra and Sulawesi continue to face persistent barriers, resulting in lower utilization.[11] Socioeconomic disparities, reflected in insurance membership, also play a role. Participants in subsidized schemes (PBI and non-workers) had lower utilization than formally employed members, consistent with evidence showing that low-income women experience barriers beyond financial coverage, including lower health literacy, logistical constraints, and reduced provider availability.[8] These factors interact, with the largest disparities observed among disadvantaged insurance groups residing in underserved regions, where geographic and socioeconomic barriers compound one another.[34] Finally, maternal age emerged as an important determinant: older pregnant women accessed more ultrasounds, reflecting

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clinical practice where advanced maternal age is linked to higher risks of complications and therefore prompts more frequent monitoring.[38]

This study has several limitations. First, it relies on administrative claims data that do not provide clinical context such as gestational age, pregnancy complications, or the medical rationale behind ultrasound referrals. Second, the analysis only includes outpatient hospital-based ultrasound visits that occurred between January 1 and December 31, 2023. This means the study does not capture utilization across the full course of pregnancy, particularly for women whose antenatal care spanned beyond the calendar year. Third, pregnant women who did not access hospital care during this period, either due to low-risk status, preference for primary care, or limited access in remote areas, were not represented. This may result in selection bias. Fourth, the identification of ultrasound visits was based on INA-CBG codes, which may vary in accuracy due to differences in coding practices across facilities. Lastly, as a cross-sectional study, the analysis can describe associations but cannot establish causal relationships between sociodemographic factors and ultrasound utilization. Despite these limitations, the study has notable strengths, including the use of a large, nationally representative claims dataset, application of robust statistical models, and provision of new evidence on ultrasound utilization patterns in Indonesia, which has not previously been studied using real-world data.

CONCLUSION

To address the persistent disparities in ultrasound utilization under the national health insurance scheme, we recommend targeted policy efforts for both BPJS Healthcare and local health authorities. These should include expanding portable ultrasound services, strengthening referral mechanisms, and providing focused training for providers in underserved areas. In regions outside Java and Bali, additional support such as transport assistance or referral coordination may be necessary to reduce access barriers. Routine monitoring of referral patterns by region and insurance segment can help ensure that clinical needs, not logistical or administrative limitations, determine access to diagnostic services.

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Declarations

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Additional information	:	Cleaned and processed data used in this study are available upon reasonable request to the corresponding author. The full raw dataset can be requested directly from BPJS Kesehatan via the official portal at data.bpjs-kesehatan.go.id.