



MATERNAL DELIVERY COMPLICATIONS AMONG HIGH-RISK MOTHERS: EVIDENCE FROM THE 2023 INDONESIAN HEALTH SURVEY

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ABSTRACT

Maternal mortality remains a significant public health challenge in Indonesia, with childbirth complications being a primary contributing factor. This cross-sectional study examined the relationship between maternal age and parity and the occurrence of childbirth complications using data from the 2023 Indonesian Health Survey (Indonesian Health Survey/SKI). A total of 64,000 mothers (weighted sample: 17,956,052) who delivered between 2018 and 2023 were included, with complex sample weighting applied to ensure national representativeness. Bivariable analysis using chi-square tests and multivariable logistic regression were performed to identify independent risk factors for childbirth complications. The prevalence of childbirth complications was 21.22%. Multivariable analysis revealed that mothers aged >35 years had higher odds of experiencing complications (AOR = 1.359; 95% CI: 1.248–1.480) compared to those aged 20–35 years. Conversely, nulliparous and primiparous mothers showed the highest complication rates (21.01%), while multiparous mothers had significantly lower odds (AOR = 0.715; 95% CI: 0.629–0.776). Geographic factors, antenatal care (ANC) frequency, and access to healthcare facilities also demonstrated significant associations with childbirth complications. Advanced maternal age (>35 years) and low parity significantly increase the risk of childbirth complications in Indonesia. Strengthening family planning programs, enhancing the quality of antenatal care, and improving healthcare access are essential strategies to reduce maternal morbidity and mortality.

Keywords: childbirth complications, maternal age, parity, high-risk pregnancy, Indonesia

Introduction (Pendahuluan)

Maternal mortality remains a critical public health challenge globally, particularly in low- and middle-income countries. According to the World Health Organization (WHO), approximately 800 women die daily from preventable causes related to pregnancy and childbirth, with complications during delivery

contributing to approximately 75% of all maternal deaths, including severe hemorrhage, infection, hypertensive disorders, and obstructed labor¹. Between 2000 and 2020, the global maternal mortality ratio (MMR) declined by more than 34%, yet in 2020 more than 95% of all maternal deaths still occurred in low- and middle income countries, with MMR reaching 430 deaths per 100,000 live births in low income

countries compared to only 13 per 100,000 in high income countries ². In the Asia Pacific region, the average MMR stands at 127 per 100,000 live births, with Southeast Asia recording 100 deaths per 100,000 live births in 2020 ³. Indonesia ranks third highest in Southeast Asia at 173 deaths per 100,000 live births far exceeding the Sustainable Development Goals (SDGs) target of fewer than 70 deaths per 100,000 live births by 2030 ^{3 4}. This persistent gap underscores the urgent need to identify modifiable risk factors that contribute to childbirth complications in Indonesian.

Among the recognized determinants of maternal morbidity, high-risk maternal characteristics, particularly advanced maternal age (>35 years), adolescent pregnancy (<20 years), and high parity (≥ 5 births), have been consistently identified in the literature as significant contributors to adverse obstetric outcomes. The “four too” framework (too young, too old, too many, and too close) remains a foundational concept in maternal health, with evidence showing that mothers delivering before age 20 have a 41% higher mortality risk compared to those aged 20–35 years, while mothers aged >35 years face significantly elevated perinatal mortality risk.⁵ Kurniati & Rahmawati (2018) reported that mothers aged >35 years carry twice the risk of delivery complications compared to those aged 20–35 years⁶, while Simarmata et al. (2015) demonstrated that parity ≥ 4 is associated with an 8% higher complication risk compared to mothers with 2-3 children⁷. Internationally, studies have demonstrated that women aged ≥ 35 years face substantially elevated risks of preeclampsia, placenta previa, gestational diabetes, and preterm labor ^{8 9 10}, while adolescent mothers face increased risks of cephalopelvic disproportion, prolonged labor, and postpartum hemorrhage due to reproductive organ immaturity^{11 12}. Regarding parity, Shechter et al. (2010) found a significant linear relationship between parity and adverse maternal outcomes¹³, while Alsammani & Ahmed (2015) identified grand multiparity as independently associated with cesarean delivery, fetal macrosomia, and pregnancy-induced hypertension ¹⁴. More recently, Dai et al. (2023) demonstrated interaction effects between age and parity on

specific obstetric complications among 15,861 women, and Putri & Warnaini (2023) in a systematic review confirmed that both advanced maternal age and parity status are significant risk factors for childbirth complications, with complication risk increasing progressively with maternal age^{15 16}.

Despite the growing body of international evidence, significant research gaps remain in Indonesian. Most existing Indonesian studies have been conducted in facility-based settings with limited sample sizes, restricting their generalizability to national populations. Prior Indonesian studies including Simarmata et al. (2015) and Kurniati & Rahmawati (2018) examined risk factors using older datasets from the 2010 Basic Health Research (Riskesdas)^{7 6}, while Adisasmita et al. (2015) analyzed obstetric outcomes using retrospective hospital data¹⁷, and Armini & Sulyastini (2020) conducted single-facility studies in Bali¹⁷. These analyses predate significant developments in Indonesia's maternal health system, including the expansion of universal health coverage, the introduction of updated antenatal care (ANC) standards under Permenkes No. 21/2021 requiring a minimum of six ANC visits with integrated 10T assessment components, and shifts in demographic and geographic access patterns¹⁸. Critically, no large-scale national study has yet examined the joint and independent effects of maternal age and parity on childbirth complications using the most recent nationally representative data, while simultaneously adjusting for socioeconomic, geographic, and healthcare access covariates within a complex sample framework.

This research gap is particularly important given notable demographic patterns in Indonesia, where 31.6% of mothers deliver at a high-risk age according to BPS (2023), and 5.92% of mothers have high parity¹⁹, with substantial geographic and socioeconomic disparities continuing to influence maternal health outcomes across the archipelago. Furthermore, while prior research has examined individual risk factors in isolation, the potential confounding and mediating roles of factors such as ANC frequency, geographic region, household wealth, and healthcare access distance have not been comprehensively explored within a multivariable framework using nationally representative complex-sample data.

Widyaningsih (2019) noted in a decomposition analysis of Indonesian maternal complications that sociodemographic changes substantially modify the relationship between individual risk factors and complication outcomes, yet the specific mechanisms and magnitudes of these interactions remain insufficiently characterized at the national level²⁰.

The present study addresses these gaps by analyzing data from the 2023 Indonesian Health Survey (SKI 2023), a nationally representative survey integrating the Basic Health Research (Riskesdas) and the Indonesian Toddler Nutritional Status Survey (SSGI), conducted by the Ministry of Health of the Republic of Indonesia across 38 provinces and 514 districts, covering 64,000 mothers (weighted sample: 17,956,052) who delivered between 2018 and 2023²¹. By applying complex sample weighting and multivariable logistic regression, this study aims to provide robust, nationally representative estimates of the independent and adjusted associations between high-risk maternal characteristics specifically maternal age and parity and the occurrence of childbirth complications, while controlling for socioeconomic, geographic, and healthcare access factors. The findings are intended to inform evidence-based policy and programmatic strategies for reducing maternal morbidity and mortality in Indonesia, with particular relevance to strengthening family planning programs, improving antenatal care quality, and targeting interventions for high-risk maternal groups in support of Indonesia's achievement of SDGs maternal mortality targets by 2030.

Methods

(Metode Penelitian)

This study used a cross-sectional design analyzing secondary data from the 2023 Indonesian Health Survey (SKI 2023), a nationally representative survey conducted by the Ministry of Health of the Republic of Indonesia across 38 provinces and 514 districts, covering the period 2018-2023. After applying inclusion and exclusion criteria, the final analytical sample comprised 64,000 mothers with a weighted sample of 17,956,052, representing the national population of delivering mothers.

The dependent variable was the occurrence of at least one childbirth complication (yes/no), including hemorrhage, prolonged labor, premature rupture of membranes, hypertension, malpresentation, and others. Primary independent variables were maternal age (<20, 20-35 as reference, >35 years) and parity (nulliparous/primiparous as reference, multiparous, grand multiparous). Covariates included education level, employment status, household wealth, province of residence, area of residence, ANC visit frequency, and travel time to the nearest health facility.

Complex sample weighting was applied throughout all analyses to ensure national representativeness. Bivariable analysis used Chi-square tests and simple logistic regression to produce Crude Odds Ratios (COR) with 95% CI. Variables with $p < 0.25$ were entered into multivariable logistic regression to generate Adjusted Odds Ratios (AOR) with 95% CI. Model fit was assessed using the Hosmer-Lemeshow test. Statistical significance was defined as a 95% CI not crossing 1.

Ethical clearance was obtained from the Ethics Committee of the Faculty of Public Health, Universitas Indonesia (No. Ket-438/UN2.F10.D11/PPM.00.02/2025). Data access permission was granted by the Ministry of Health of the Republic of Indonesia. All data were fully anonymized prior to analysis.

Results and Discussion

(Hasil dan Pembahasan)

a. Prevalence and Types of Childbirth Complications

Analysis of SKI 2023 data revealed that the weighted prevalence of childbirth complications among Indonesian mothers was 21.22%, substantially higher than the unweighted estimate of 17.29% (Table 1). This discrepancy is scientifically significant: the difference between weighted and unweighted estimates confirms that populations experiencing childbirth complications are systematically underrepresented in raw survey samples, a phenomenon arising from the unequal probability of selection inherent in multistage stratified cluster sampling designs. Without weighting correction,

national prevalence estimates would underestimate the true burden of childbirth complications by approximately four percentage points, potentially misleading policy decisions. The weighted estimate representing approximately 3.81 million affected mothers out of 17.96 million deliveries nationally demonstrates that

childbirth complications remain a substantial public health burden in Indonesia, directly contributing to the country's persistently high maternal mortality ratio of 173 per 100,000 live births, far exceeding the SDGs target of <70 per 100,000 live births by 2030³.

Variable	Unweighted		Weighted*	
	N	%	n	%
Childbirth Complication				
Yes	11.066	17,29	3.811.078	21,22
No	52.934	82,71	14.144.974	78,78
Maternal Age				
<20 years	2.688	4,20	1.143.317	6,37
20-35 years	47.280	73,88	13.933.318	77,60
>35 years	14.032	21,93	2.879.417	16,04
Parity				
Nulliparous and Primiparous	15.371	24,02	5.376.458	29,94
Multiparous	45.294	70,77	12.076.075	67,25
Grand multiparous	3.335	5,21	503.518	2,80
Education Level				
No Schooling	3.955	6,18	919.157	5,12
Primary	10.056	15,71	2.960.788	16,49
Junior Secondary	12.848	20,07	4.137.672	23,04
Senior Secondary	24.396	38,12	7.069.199	39,37
Higher Education	12.745	19,91	2.869.236	15,98
Pekerjaan				
Not Working	36.898	57,65	11.376.871	63,36
Working	27.102	42,35	6.579.181	36,64
Province of Residence				
Java-Bali	18.154	28,37	10.349.400	57,64
Sumatera	19.763	30,88	3.759.506	20,94
Kalimantan	6.382	9,97	1.060.283	5,90
Sulawesi	10.040	15,69	1.393.661	7,76
Nusa Tenggara, Maluku, Papua	9.661	15,10	1.393.202	7,76
Area of Residence				
Rural	33.121	51,75	10.291.737	57,32
Urban	30.879	48,25	7.664.315	42,68
Household Wealth				
Poor	16.009	25,01	4.069.572	
Middle	31.818	49,72	9.344.039	22,66
Wealthy	16.173	25,27	4.542.442	52,04
				25,30
ANC Visits				
< 6 visits	25.639	40,06	5.765.827	32,11
≥6 visits	38.361	59,94	12.190.225	67,89
Travel Time to Health Facility				
≤ 30 minutes	60.657	94,78	17.462.531	97,25
> 30 minutes	3.343	5,22	493.539	2,75
Total	64.000	100	17.956.052	100

The majority of mothers were aged 20-35 years (77.60%), with 16.04% aged >35 years and 6.37% aged <20 years. Most mothers were multiparous (67.25%), followed by nulliparous/primiparous (29.94%), and grand multiparous (2.80%). From a healthcare access perspective, 67.89% completed ≥ 6 ANC visits and 97.25% had travel time ≤ 30 minutes to the nearest health facility, suggesting relatively adequate physical access to care at the national level, though quality of care remains a separate concern addressed later in this discussion.

The most prevalent complications were premature rupture of membranes (3.09%), prolonged labor (2.81%), and hypertension (2.68%), followed by malpresentation (2.48%) and umbilical cord entanglement (1.57%), as presented in Table 2. This distribution pattern reflects the interplay between biological risk factors and systemic healthcare quality. Premature rupture of membranes as the leading complication is consistent with global evidence linking it to ascending genital tract infection, nutritional deficiencies, and inadequate antenatal surveillance²². The high prevalence of prolonged labor reflects contributions of cephalopelvic disproportion, malpresentation, and uterine contractility disorders conditions theoretically preventable through adequate antenatal screening. Hypertensive disorders as the third most common complication align with WHO's identification of preeclampsia and eclampsia among the five leading causes of maternal death globally²³.

Table 2. Type of Complication

No	Type of Complication	N	%
1	Malpresentation	1.615	2,48
2	Hemorrhage	798	1,16
3	Convulsions	61	0,07
4	Premature Rupture of Membranes (PROM)	2.037	3,09
5	Prolonged Labor	1.820	2,81
6	Umbilical Cord Entanglement	1.029	1,57
7	Placenta Previa	408	0,62
8	Solusio Placenta	242	0,37
9	Hipertensi	1.739	2,68
10	Komplikasi Lain	2.493	3,88

- b. Maternal Age and Childbirth Complications
- Bivariable analysis demonstrated a statistically significant association between maternal age and childbirth complications ($p=0.000$). As presented in Table 3, mothers aged >35 years showed the highest complication proportion (19.15%), followed by those aged 20-35 years (16.84%) and <20 years (15.59%). After multivariable adjustment controlling for all covariates, mothers aged >35 years retained significantly higher odds of complications (AOR=1.359; 95% CI: 1.248-1.480), representing a 36% increase in odds compared to the reference group (Table 5).

Table 3. Bivariable Analysis of Chidbirth Complication with Age

Maternal Age	Complication				Total		p-Value
	Normal		Complication		n	%	
	n	%	n	%	n	%	
20-35 years (ref)	39.320	83,16	7.960	16,84	47.280	100	0,000
< 20 years	2.269	84,41	419	15,59	2.688	100	
> 35 years	11.345	80,85	2.679	19,15	14.032	100	
Total	52.934	100	11.066	17,29	64.000	100	

This finding directly addresses the study's primary objective and is scientifically explained by well-established biological mechanisms of reproductive aging. After age 35, progressive decline in ovarian reserve, uterine muscle elasticity, and endometrial vascularity collectively impair placentation, uterine contractility, and fetal-maternal oxygen exchange²⁴. Simultaneously, the accumulation of chronic comorbidities particularly hypertension, type 2 diabetes, and subclinical cardiovascular disease that characteristically emerges in this age group creates a physiologically hostile environment for pregnancy, predisposing to preeclampsia, gestational diabetes, placenta previa, and preterm labor¹². This finding is consistent with Xu et al. (2018), who demonstrated progressive increases in complication rates with advancing maternal age ($p<0.05$ for multiple complications) in a Chinese hospital-based cohort of 4,552 women⁹. Cavazos-Rehg et al. (2015) similarly confirmed

that women aged ≥ 35 years had significantly elevated odds of preterm delivery, hypertension, superimposed preeclampsia, and severe preeclampsia⁸. Baser et al. (2013) further reported that nearly all studied obstetric complications were more prevalent among women aged ≥ 40 years compared to younger controls ($p < 0.05$)¹⁰.

A scientifically notable observation is that advanced maternal age mothers tended to come from higher socioeconomic groups, yet still demonstrated the highest complication rates. This paradox confirms that economic advantage does not confer protection against biologically-mediated reproductive aging risks, and that interventions for this group must specifically address the biological risk profile through intensified clinical surveillance and comorbidity screening rather than relying on socioeconomic improvements alone.

The unexpected finding that adolescent mothers (<20 years) showed lower complication odds (AOR=0.723; 95% CI: 0.605-0.864) requires careful scientific interpretation. This result contradicts established theory and prior studies: Abbas & Abdullah (2020) documented that reproductive organ immaturity in adolescents commonly causes uterine rupture and prolonged labor, Cavazos-Rehg et al. (2015) identified ages 11-18 years as carrying the highest odds of preterm labor and chorioamnionitis, and Regina et al. (2019) reported cephalopelvic disproportion as the most prevalent complication (59.7%) among adolescent mothers^{12 8}. Three mechanisms most plausibly explain this paradox. First, healthy survivor bias operates powerfully: adolescent mothers captured in the survey successfully completed delivery, while those experiencing the most severe complications miscarriage, stillbirth, or maternal death were not captured, creating a systematically healthier surviving sample. Second, the small weighted proportion of adolescent mothers (6.37%) substantially limits statistical power, producing potentially unstable AOR estimates. Third, adolescent mothers in Indonesia may receive disproportionately intensive antenatal monitoring as recognized high-risk patients, partially mitigating clinical complications. Regardless of the statistical finding, adolescent pregnancy warrants

continued policy prioritization given well-documented biological and psychosocial risks.

c. Parity and Childbirth Complications

Parity showed a statistically significant association with childbirth complications ($p=0.000$), as presented in Table 4. Nulliparous and primiparous mothers carried the highest complication rate (21.01%), while multiparous (16.32%) and grand multiparous mothers (13.37%) showed progressively lower rates. Multivariable analysis confirmed that multiparous mothers had significantly lower odds compared to the reference group (AOR=0.715; 95% CI: 0.629-0.776), with grand multiparous mothers showing even lower odds (AOR=0.645; 95% CI: 0.526-0.789) (Table 5).

Parity	Complications				Total		P-Value
	Normal		Complication		n	%	
	N	%	N	%			
Nulliparous and Primiparous	12.141	78,99	3.230	21,01	15.371	100	0,000
Multiparous	37.904	83,68	7.390	16,32	45.294	100	
Grand multiparous	2.889	86.63	446	13,37	3.335	100	
Total	52.934	82.71	11.066	17.29	64.000	100	

The elevated risk among nulliparous and primiparous mothers is scientifically explained by the absence of prior physiological birth canal adaptation. In first-time deliveries, the cervix has not previously undergone biochemical and structural remodeling including collagen degradation, increased water content, and prostaglandin-mediated softening resulting in slower, more resistant effacement and dilation that directly predisposes to prolonged labor, chorioamnionitis, fetal distress, and operative delivery²². Psychologically, nulliparous mothers experience significantly higher labor anxiety, which suppresses endogenous oxytocin release through cortisol-mediated pathways, further compromising uterine contractility²⁵. These findings are consistent with Regina et al. (2019), who reported significant parity-complication associations ($p=0.001$), and Shechter et al. (2010), who demonstrated a linear relationship between parity and adverse outcomes including labor dystocia

and cesarean delivery^{11 13}. Dai et al. (2023) further confirmed distinct parity-specific complication profiles, finding that anemia, placental abruption, premature rupture of membranes, and macrosomia were specifically parity-associated rather than age-associated, confirming that parity and age operate through distinct biological pathways¹⁵.

The lower odds among grand multiparous mothers diverge from theoretical expectations, as literature consistently identifies grand multiparity as a risk factor for atonic hemorrhage due to progressive myometrial fibrosis, placenta previa, and uterine rupture^{14 8}. The most scientifically defensible explanation is a compound healthy survivor effect: grand multiparous mothers who have completed five or more pregnancies represent a highly self-selected population with superior physiological tolerance for repeated gestational stress. The small subgroup size (2.80% weighted) additionally limits statistical precision. Clinical vigilance for grand multiparity-specific complications must therefore be maintained regardless of population-level statistical findings.

d. Socioeconomic, Geographic, and Healthcare Access Determinants

Table 5 presents the complete COR and AOR results for all variables included in the multivariable model. Among socioeconomic variables, only primary education showed a significant association (AOR=0.758; 95% CI: 0.659-0.871), while other educational categories, employment status, and household wealth did not reach significance after adjustment. The paradoxical finding of lower complication odds in less-educated mothers reflects differential detection bias: more educated mothers access facilities with superior diagnostic capacity and are more inclined to report complications, producing systematically higher recorded rates. This aligns with Li et al. (2023), who demonstrated that education's effect on pregnancy outcomes is non-linear and substantially modified by socioeconomic context, and with Budu et al. (2021), who noted that education operates through healthcare-seeking behavior rather

than as a direct biological protective factor^{26 27}. The non-significance of household wealth confirms that economic status influences complications primarily through indirect pathways captured by other model variables, consistent with Adisasmita et al. (2015)¹⁷.

All regions outside Java-Bali demonstrated significantly lower complication odds, most parsimoniously explained by surveillance bias: Java-Bali's superior health infrastructure enables more comprehensive detection and recording of complications that go undetected in regions with limited capacity. Adisasmita et al. (2015) supported this by finding higher case fatality rates in regions with limited access, confirming that lower recorded rates reflect underdetection rather than lower true incidence¹⁷. Rural residence showed lower odds than urban (AOR=0.891; 95% CI: 0.821–0.967), consistent with the same surveillance bias mechanism, though documented rural disadvantages in skilled birth attendance and emergency referral capacity indicate that true complication risks may be higher despite lower recorded rates²⁷.

The finding that ANC visits <6 times showed lower complication odds (AOR=0.777; 95% CI: 0.716-0.843) is explained by reverse causality: high-risk mothers are recommended more frequent visits, making higher ANC frequency a consequence rather than a cause of elevated risk. Tholandi et al. (2019) demonstrated in the EMAS program evaluation that high ANC attendance did not automatically improve outcomes when care quality was suboptimal, with initial partograph utilization of only 30.2% despite routine attendance²⁸. This confirms that quality of ANC including full implementation of integrated 10T/12T standards (Permenkes, 2021) is more critical than visit frequency alone¹⁸. Similarly, lower complication odds among mothers with travel time >30 minutes (AOR=0.737; 95% CI: 0.593-0.917) reflect survival selection bias, while Adisasmita et al. (2015) confirmed that geographic distance remains a critical contributor to maternal near-miss events and death in Indonesia¹⁷.

Variable	COR (95% CI)	AOR(95%CI)
Maternal Age 20-35 years		
< 20 years	0,775 (0,657-0,913)	0,723 (0,605-0,864)
> 35 years	1,179 (1,091-1,274)	1,359 (1,248-1,480)
Parity		
Nulliparous and Primiparous		
Multiparous	0,778(0,722-0,838)	0,715 (0,629-0,776)
Grand multiparous	0,641(0,532-0,772)	0,645 (0,526-0,789)
Education Level		
Higher Education		
Primary	0,663(0,590-0,745)	0,758(0,659-0,871)
Junior Secondary	0,827(0,745-0,917)	0,906(0,801-1,024)
Senior Secondary	0,935(0,856-1,021)	0,986(0,894-1,088)
No Schooling	0,651(0,292-0,337)	0,882(0,726-1,071)
Employed Status		
Working		
Not Working	0,973(0,909-1,042)	1,017(0,945-1,094)
Household Wealth		
Wealthy		
Poor	0,682(0,618-0,752)	0,896(0,796-1,008)
Middle	0,811(0,748-0,878)	0,923(0,843-1,010)
Province of Residence		
Java and Bali		
Sumatera	0,484 (0,447-0,523)	0,525 (0,481-0,573)
Kalimantan	0,489 (0,441-0,544)	0,542 (0,485-0,605)
Sulawesi	0,545 (0,496-0,598)	0,628 (0,566-0,697)
Nusa Tenggara, Maluku, Papua	0,438 (0,392-0,489)	0,522 (0,462-0,590)
Area of Residence		
Urban		
Rural	0,695(0,647-0,746)	0,891(0,821-0,967)
ANC Visits		
≥6 visits		
< 6 visits	0,627(0,581-0,676)	0,777(0,716-0,843)
Travel Time to Health Facility		

≤ 30 minutes		
> 30 minutes	0,438 (0,357-0,537)	0,737 (0,593-0,917)

Conclusion (Simpulan)

This study provides nationally representative evidence on the determinants of childbirth complications among Indonesian mothers using SKI 2023 data, with a weighted sample of 17,956,052 delivering women. The weighted prevalence of childbirth complications was 21.22%, indicating that more than one-fifth of Indonesian mothers experience at least one complication during delivery. This represents a substantial and persistent public health burden and contributes to Indonesia's maternal mortality ratio remaining far above the SDGs target of <70 per 100,000 live births.

Advanced maternal age (>35 years) was independently and significantly associated with increased odds of childbirth complications (AOR=1.359; 95% CI: 1.248–1.480). This finding reflects biological deterioration of reproductive function, decreased tissue elasticity, and the accumulation of comorbidities at advanced age, which elevate obstetric risk regardless of socioeconomic status. It supports the classification of advanced maternal age as a high-risk maternal factor requiring intensified clinical surveillance and targeted intervention. Adolescent mothers (<20 years) showed paradoxically lower odds (AOR=0.723; 95% CI: 0.605–0.864), most likely attributable to healthy survivor bias and a limited subgroup sample size rather than a genuine protective effect of young age. Therefore, adolescent pregnancy warrants continued prioritization in reproductive health policy.

Parity demonstrated a significant and consistent association with childbirth complications. Nulliparous and primiparous mothers had the highest complication risk (21.01%), likely due to the absence of prior physiological birth canal adaptation, cervical rigidity, and psychosocial unpreparedness. Multiparous mothers showed significantly lower odds (AOR=0.715; 95% CI: 0.629–0.776), reflecting accumulated physiological and psychological adaptation to the birth process.

Grand multiparous mothers showed the lowest statistical odds (AOR=0.645; 95% CI: 0.526–0.789); however, this finding is most likely attributable to healthy survivor bias and small subgroup representation rather than genuinely lower biological risk. Clinical vigilance for parity-specific complications such as uterine atony and postpartum hemorrhage must therefore be maintained.

Geographic factors were significant determinants, with all regions outside Java–Bali showing lower recorded complication odds. This is most plausibly explained by surveillance bias, reflecting differences in detection capacity across Indonesia's health system rather than genuinely lower complication incidence in peripheral regions. Similarly, the findings related to ANC frequency and healthcare access distance likely reflect methodological phenomena, namely reverse causality and survival selection bias, rather than true protective effects. These results reinforce that the quality of antenatal care is more critical than the number of visits, and that geographic barriers to emergency obstetric care remain a priority concern.

Collectively, these findings demonstrate that strengthening family planning programs to prevent pregnancies at age extremes, improving the quality of antenatal care through full implementation of integrated 10T/12T ANC standards, intensifying surveillance for primiparous and advanced-age mothers, and addressing health system inequalities across Indonesian regions are essential, evidence-based strategies to reduce childbirth complications and achieve SDGs maternal mortality targets by 2030.

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