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Fertility Trends and Determinants in North Sumatra Province, Indonesia (1990–2040): A Longitudinal Analysis

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Abstract
This study aims to analyze fertility trends in North Sumatra Province over the period from 1990 to 2040, based on projection data from Statistics Indonesia (Badan Pusat Statistik). The primary focus is on the changes in the Total Fertility Rate (TFR) and the Gross Reproduction Rate (GRR), as well as their associations with marriage rates and poverty levels. The findings indicate a sharp decline in TFR from 4.3 to 1.3 and in GRR from 2.50 to 1.62. Despite declining fertility rates, the absolute number of births has increased due to the growing number of women of reproductive age. The decline in fertility is also linked to a reduction in the number of marriages, primarily attributed to rising age at first marriage, improved education, increased female labor force participation, and the influence of regulatory frameworks. Furthermore, improved economic conditions and decreasing poverty levels have contributed to a growing preference for smaller families. In conclusion, fertility dynamics in the region are shaped by a complex interplay of demographic, sociocultural, and economic factors. These findings are expected to serve as a foundation for formulating population policies and planning for sustainable development.

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Introduction

Fertility is a fundamental component of population dynamics that significantly influences demographic structure and development planning. In demographic terms, fertility is not merely the biological capacity of women to bear children but is also shaped by a range of socio-economic and cultural factors. High fertility rates may accelerate population growth, increasing pressure on public services such as healthcare, education, and employment. Conversely, sustained fertility decline may lead to population aging and a shrinking labor force in the long term (Bloom, Canning, & Sevilla, 2010; Bongaarts, 2008) [1, 2].

North Sumatra, one of Indonesia's most populous provinces, has undergone significant fertility transitions in recent decades. According to projections by Statistics Indonesia (BPS), the province's Total Fertility Rate (TFR) fell sharply from 4.3 children per woman in 1990 to a projected 1.3 in 2040 (BPS, Bappenas, & UNFPA, 2013) [3]. A similar trend is observed in the Gross Reproduction Rate (GRR), which declined from 2.50 to 1.62 during the same period, albeit with a temporary increase in 2010. These patterns point to profound socio-cultural transformations, including greater female participation in education and the labor market, as well as the effectiveness of family planning policies (Adioetomo & Samosir, 201; BKKBN, 2017) [4, 5].

Interestingly, despite the declining fertility rates, the absolute number of births increased from 270,200 in 1990 to 303,000 in 2040. This paradox is explained by the expanding population of women of reproductive age, which continues to produce a high aggregate number of births despite declining individual fertility (BPS, 2021) [6].This finding emphasizes the need to consider reproductive-age population structures in fertility analysis.

Marriage rates have also seen a notable decline, especially between 2021 and 2023, reflecting broader social trends such as delayed marriage due to increasing educational attainment, career prioritization, and changes in legal regulations, such as Law

No. 16 of 2019, which raised the legal minimum age of marriage (Kemen PPPA, 2024) [7]. Urbanization and shifting cultural values have further contributed to changes in marriage behavior, particularly among younger generations (BRIN, 2023) [8].

From an economic perspective, the poverty rate in North Sumatra decreased from 10.53% in 2018 to 8.75% in 2020 (BPS Sumut, 2021). Improved living conditions generally correlate with reduced fertility preferences, as families increasingly opt for smaller households and gain access to better education, healthcare, and family planning services (UNFPA Indonesia, 2020) [9]. These trends are consistent with demographic transition theory, which postulates that economic development leads to lower fertility (Notestein, 1945; Bongaarts, 2008) [10, 2].

Methods

This study uses a quantitative descriptive approach with a secondary data analysis method. The data were obtained through literature review and analysis of demographic projections and socio-economic statistics published by official institutions. The procedure for this study is as follows:

1. Problem formulation

At this stage, the author defines the core problems related to fertility trends in North Sumatra, particularly changes in Total Fertility Rate (TFR) and Gross Reproduction Rate (GRR), and how these are influenced by marriage patterns and poverty levels.

2. Literature search

The author conducted a literature search using official demographic publications such as the *Indonesian Population Projection 1990–2040* by Statistics Indonesia (BPS), reports from the National Development Planning Agency (Bappenas), UNFPA, and relevant peer-reviewed journal articles. The sources were selected based on their relevance to fertility, marriage, and economic indicators.

3. Data evaluation

The collected data were evaluated based on completeness, credibility, and alignment with the research objectives. Data included time-series projections of TFR, GRR, number of births, marriage statistics, and poverty rates specific to North Sumatra Province.

4. Data analysis and interpretation

The data were analyzed descriptively using graphical and tabular presentations to illustrate longterm trends. A comparative analysis was also conducted to explore relationships between fertility indicators and influencing factors such as the number of marriages and poverty. The analysis aims to interpret how socio-economic and demographic changes contribute to the overall fertility transition in the region.

Results and Discussion

1. Results

Based on the literature search conducted by the author, a total of seven research journals and official reports were found that discuss the trends and determinants of fertility in North Sumatra and Indonesia as a whole. These sources include population projections, statistical records, and demographic studies published by national institutions such as Statistics Indonesia (BPS), Bappenas, and UNFPA.

The selected journals were then evaluated and analyzed based on their relevance to the topic, the credibility of the data, and the consistency of findings with the objectives of this study.

Table 1: Summary of Fertility-Related Studies Used in the Literature Review

No	Title	Year	Writer	Research result
1.	Proyeksi Penduduk Indonesia 1990–2040	2013	BPS, Bappenas, UNFPA [3].	TFR declined from 4.3 to 1.3; GRR from 2.50 to 1.62.
2.	Statistik Pernikahan dan Kemiskinan Sumatera Utara	2021-2023	BPS Sumatera Utara [11, 12]	Number of marriages declined; poverty rate decreased from 10.53% to 8.75%.
3.	Determinan Fertilitas di Indonesia (SDKI 2017)	2019	Jatmiko & Wahyuni [13]	Economic status and women's education have a significant effect on fertility.
4.	*Analisis Fertilitas Provinsi Sumatera Utara*	2020	Prastiyawan *et al*. [14].	TFR, GRR, and NRR declined, but the number of births increased due to a rise in reproductive-age women.
5.	Studi Kawin Muda dan Urbanisasi di Kalangan Generasi Muda	2023	BRIN [8]	Age at first marriage increased due to higher education and career focus, contributing to lower fertility.
6.	Fertilitas dan Program Keluarga Berencana di Indonesia	2011	Adioetomo & Samosir [4]	Family planning participation reduced GRR and promoted smaller family preferences.
7.	Demographic Dividend dan Penurunan Kemiskinan di Indonesia	2020	UNFPA Indonesia [9]	Poverty reduction is negatively correlated with fertility through improved access to education and health.

4. Discussion

Number of Births

High population growth is primarily caused by birth rates that exceed death rates. This condition results in a dominant young population, putting more burden on the productive age group to meet the needs of those who are not yet in the workforce. The number of births refers to live births occurring within a specific time and region (Population and Civil Registration Office, 2018) [15] . Birth data is crucial in development planning, especially in providing maternal and child health services, both now and in the future. Additionally, birth data serves as the basis for various fertility indicators such as Crude Birth Rate (CBR), Age-Specific Fertility Rate (ASFR), Total Fertility Rate (TFR), Net Reproduction Rate (NRR), and Female Child Ratio.

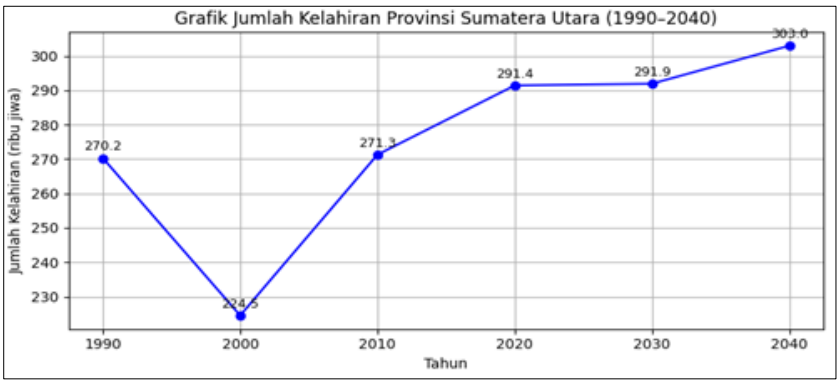

Fig 1: Trend of Birth Numbers in North Sumatra Province (1990–2040)

The graph shows an increase in the projected number of births from 270,200 in 1990 to 303,000 in 2040. The highest increase occurred between 2000 and 2010, with an addition of 46,800 births. This trend is partly due to the relatively high number of couples of reproductive age. Socio-economic factors such as family income, education level, age at first marriage, and contraceptive use also influence fertility levels. Educational level, particularly of women, plays a significant role. Higher education correlates with a desire for fewer children. Thus, the high birth projection may indicate that female education levels in North Sumatra are still relatively low. Participation in Family Planning programs is another key factor in reducing fertility rates. Likewise, household income influences fertility; while classical economics views children as long-term utility, in modern society, higher income tends to reduce the desire for more children due to the associated costs.

Total Fertility Rate (TFR)

TFR refers to the average number of live births a woman would have throughout her reproductive life, assuming no premature mortality and age-specific fertility rates remain constant (Mantra, 2013) [16]. Uncontrolled increases in TFR can significantly impact population growth.

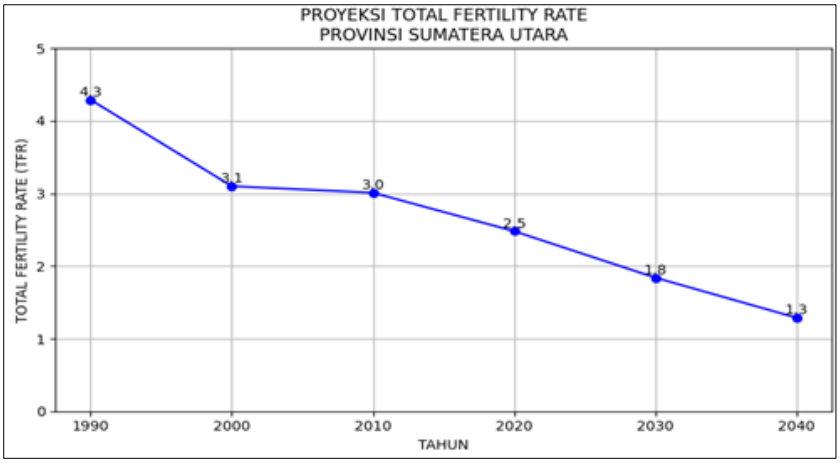

Fig 2: Projection of Total Fertility Rate (TFR) in North Sumatra Province, 1990–2040

TFR in North Sumatra decreased from 4.3 in 1990 to 3.1 in 2000, 3.0 in 2010, 2.5 in 2020, 1.8 in 2030, and is projected to reach 1.3 in 2040. This decline indicates shifts in fertility patterns possibly due to increased participation in family planning, higher female education, and changing societal norms.

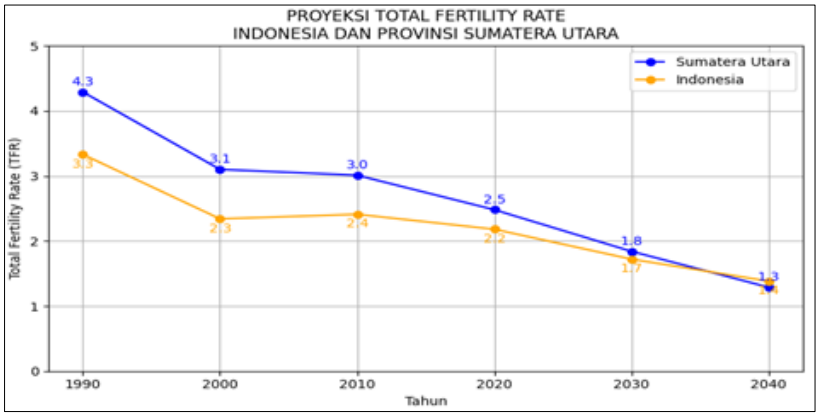

Fig 3: Projected Total Fertility Rate (TFR) in Indonesia and North Sumatra Province, 1990–2040

Until 2020, TFR in North Sumatra remained above the national average. However, both are projected to equalize at 1.3 by 2040. Since this figure is below the replacement fertility level of 2.1, it suggests potential future demographic challenges such as aging population and labor shortages.

Gross Reproduction Rate (GRR)

GRR represents the average number of daughters a woman would have, assuming no mortality before completing reproductive years.

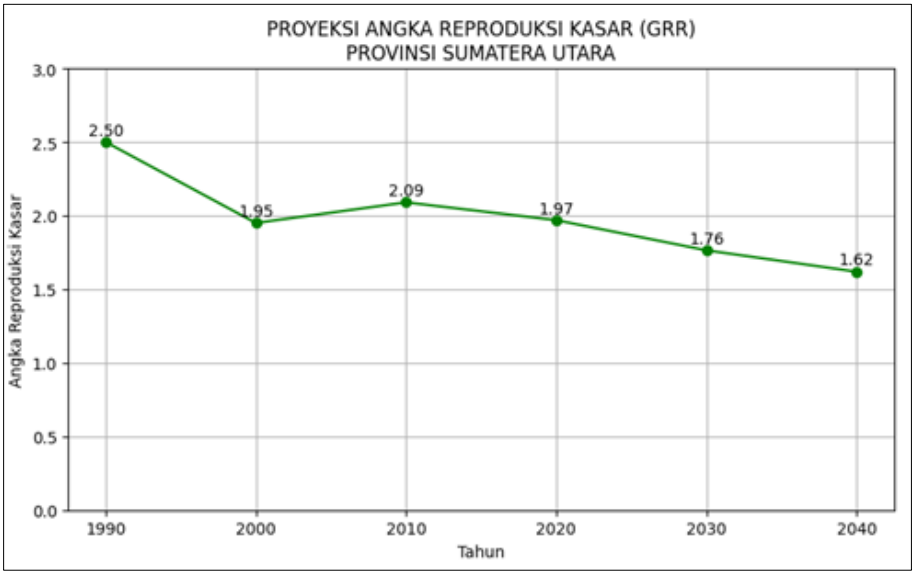

Fig 4: Projected Gross Reproduction Rate (GRR) in North Sumatra Province, 1990–2040

GRR declined from 2.50 in 1990 to 1.95 in 2000, briefly rose to 2.09 in 2010, then continued decreasing to 1.97 (2020), 1.76 (2030), and 1.62 (2040). This downward trend suggests declining potential for generational replacement among females.

Social and cultural shifts such as delayed marriage age, higher female education, and participation in the workforce are contributing factors. This indicates the need for policies anticipating future demographic changes and dependency burden.

Marriage Trends

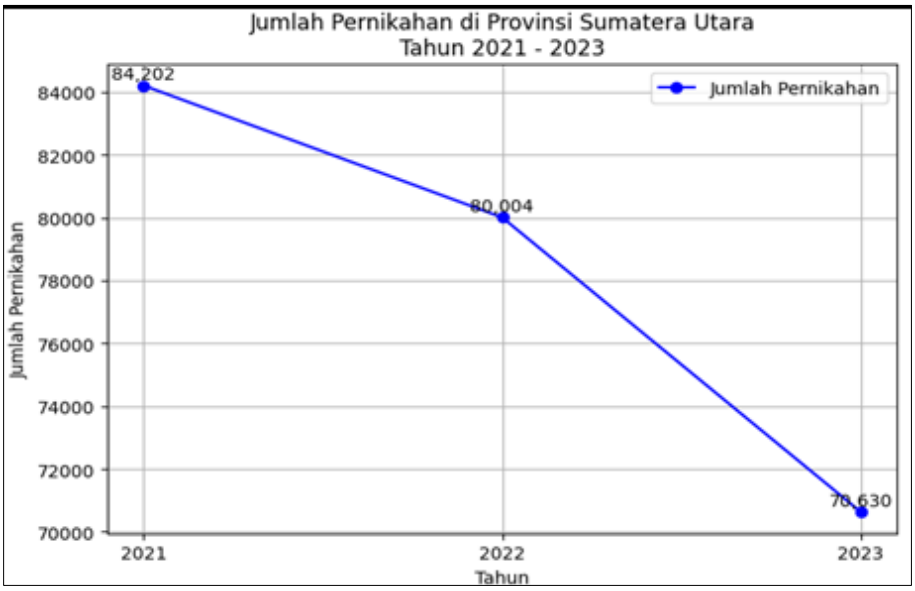

Fig 5: Number of Marriages in North Sumatra Province, 2021–2023

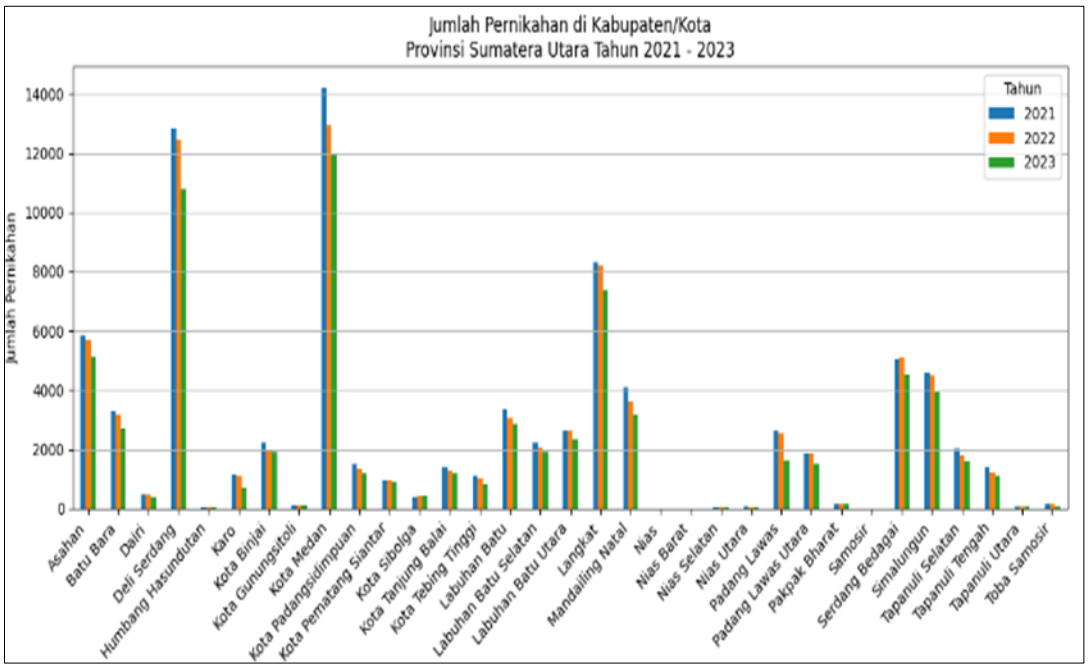

Fig 6: Number of Marriages by Regency/City in North Sumatra Province, 2021–2023

Marriage rates declined from 84,202 (2021) to 70,630 (2023). This trend was influenced by the COVID-19 pandemic, economic pressures, and regulations raising the minimum marriage age. Additionally, cultural shifts and urbanization are prompting younger generations to delay marriage.

Urban areas such as Medan and Deli Serdang exhibit higher marriage rates, likely due to population size and administrative accessibility. Meanwhile, rural and remote areas record fewer formal marriages, possibly due to unregistered customary unions.

Poverty Rate

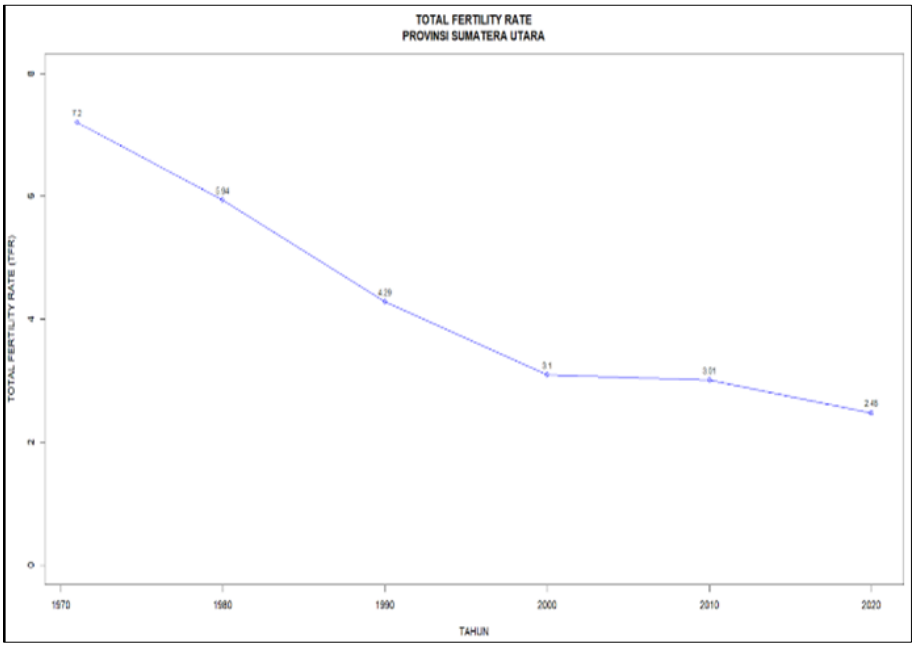

Fig 7: Total Fertility Rate (TFR) in North Sumatra Province, 1970–2020

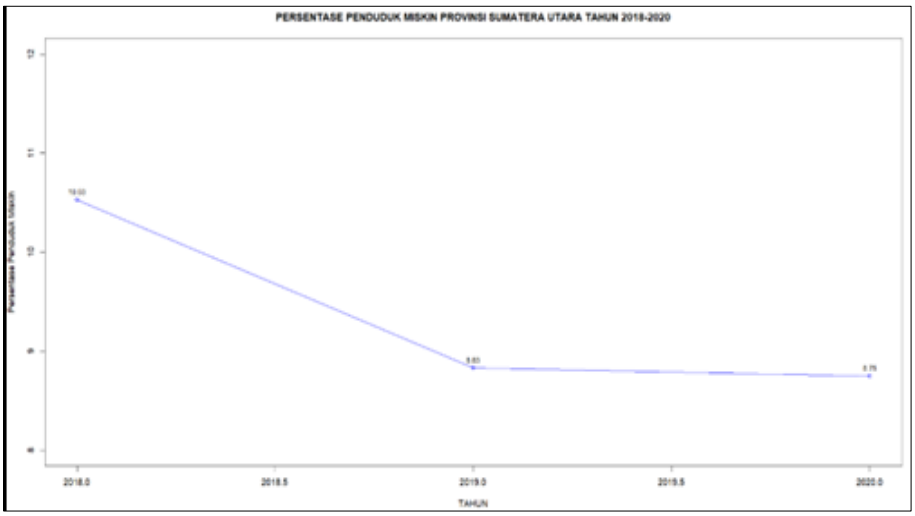

Fig 8: Poverty Rate in North Sumatra Province, 2018–2020

Between 2018 and 2020, poverty in North Sumatra declined from 10.53% to 8.75%. Although this timeframe is shorter than the fertility data, the parallel downward trends indicate a negative correlation: better welfare is associated with reduced fertility. This aligns with previous studies linking economic improvement with reduced birth rates through enhanced access to education, healthcare, and female labor participation.

Conclusion

This study has reviewed various sources to analyze fertility trends in North Sumatra from 1990 to 2040. The findings confirm a significant decline in both the Total Fertility Rate (TFR) and the Gross Reproduction Rate (GRR), reflecting a demographic transition driven by multiple interrelated factors.

Despite the decline in fertility indicators, the total number of births has increased due to the expanding population of women of reproductive age. This highlights the need for policymakers to consider not only fertility rates but also population structure in demographic planning.

The decline in marriage rates particularly among younger generations was found to be influenced by rising levels of education, career prioritization, and changes in marriage law. These social shifts have contributed to delayed childbearing and reduced fertility.

Economic development also plays a pivotal role. The reduction in poverty has been associated with increased access to education, healthcare, and family planning services, further encouraging a preference for smaller families.

In conclusion, fertility dynamics in North Sumatra are shaped by a complex interplay of demographic, socio-cultural, and economic factors. Understanding these patterns is essential for designing responsive and forward-looking population policies that support sustainable development in the region.

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