ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug228

# A Data-Driven Study of Socio-Economic and Cultural Influences on Early Pregnancy-Insights from GRETL-Based Trend Analysis

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Publication Date: 2025/08/20

**Abstract: This research study examine on how the social, economic, and cultural reasons behind the early pregnancy within the Philippines, by applying trend analysis with GRETL time series plot on data gathered from 2018 to 2022 across 16 regions. The Findings show that there will be a clear differences between areas, with higher rates in region like in Cagayan Valley, Central Luzon, and Northern Mindanao. These form suggest that early pregnancy is shaped or a result of a mix of local factors like poverty, cultural beliefs, and how easily the teenager can get health services. Even though in the urban areas like in Metro Manila, the numbers for the teenage pregnancy remain high, showing that the income alone does not explain the cause. The study highlights that there will be need and implementation for local solutions that consider each region's culture and circumstances. It also recommends the stronger sex education specially to the teenage level, better access to youth-friendly reproductive health care, and community programs that are respectful of local values, also there will be a regular data tracking to help and shape effective policies. Overall, the study offers helpful insight for reducing teen pregnancy through informed and region-specific strategies.**

***Keywords:*** *Early Pregnancy, Adolescent Fertility, Regional Disparities, Statistical Analysis, Central Tendency, Variability, Public Health Philippines, Socio-Economic Factors, Reproductive Health.*

**How to Cite:** Crispo J Seno Jr; Florence Jean B. Talirongan (2025) A Data-Driven Study of Socio-Economic and Cultural Influences on Early Pregnancy-Insights from GRETL-Based Trend Analysis. *International Journal of Innovative Science and Research Technology*, 10(8), 694-702. https://doi.org/10.38124/ijisrt/25aug228

## I. INTRODUCTION

The adolescent pregnancy defined as pregnancy among individuals aged from 13 to 19 years, It continues to pose significant public health and socio-economic challenges worldwide, particularly in the developing countries such as the Philippines [1], [2]. Early pregnancy is associated with the host of adverse outcomes, including increased health risks for both mother and a child [3], disruptions to education [4], and long-term economic disadvantages [5]. Despite ongoing efforts by both government and non-government sectors to reduce its prevalence, adolescent pregnancy rates remain high in many different regions of the country [6]. These persistent rates suggest that the deeper structural factor such as poverty, limited education, inadequate access to healthcare, and entrenched cultural norms may be influencing the reproductive behavior at the community level [7], [8].

In recent years, the notable regional disparities in the early pregnancy rates have been observed across in the Philippines [9]. Some of the regions reportedly experienced significant higher incidences than other regions, highlighting the role of contextual socio-economic and cultural variables [10]. To understand these variations it is essential for developing the effective and targeted public health interventions for the regional-level analysis, rather than relying solely on the national averages, because it offers more nuanced view of how and why early pregnancy persists despite national efforts to curb it [11].

This study employs panel data analysis to investigate the trends in the early pregnancy across all 16 administrative regions of the Philippines from the year 2018 to 2022. Using the Gnu Regression, Econometrics, and Time-series Library (GRETL) an open-source statistical software, the study explores how the factors such as poverty incidence, educational attainment, urbanization, and access to healthcare

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug228

influence adolescent pregnancy rates over time [12]. The use of panel regression models allows for a dynamic understanding of both temporal and spatial variations, enabling more robust inferences than cross-sectional or time-series analysis alone [13].

The central aim of this research is to identify which socio-economic and cultural indicators are most strongly associated with the regional variations in the early pregnancy. Also the study investigates annual incidence trends, regional distribution of key socio-economic factors, and the predictive strength of these variables using the econometric modeling. The findings offer evidence-based insights that can inform to the policy development and intervention strategies aimed at reducing the adolescent pregnancy, particularly in high-risk regions [14].

By providing a data-driven understanding of the adolescent reproductive behavior within the Philippine context, this study contributes to the broader literature on the public health, gender, and in the development. The findings are expected to be particularly relevant to the policymakers, educators, health practitioners, and community leaders seeking to design region-specific strategies that address the underlying causes of early pregnancy [15].

## II. LITERATURE REVIEW

This chapter represents the review of related literature concerning the early pregnancy, also it focusing on socio-economic and cultural factors influencing the adolescent pregnancy, as well as the methodological approaches using quantitative data analysis. The purpose of this study is to contextualize the current research, with an emphasis on recent works published around year 2020.

➢ *Early Pregnancy: Definition and Implications*

The adolescent pregnancy, defined as the pregnancy among girls aged from 13 to 19 years, remains a critical issues problem not only in the Philippines but it is globally concerning problem, especially in a low -income and in the middle-income countries. Also according to the World Health Organization [22] it highlighted the health risks associated with the adolescent pregnancy, it including the increased maternal mortality, the preterm births, and the low birth weight infants. The social consequences, such as the interrupted education and the economic hardship, often exacerbate these health challenges.

➢ *Socio-Economic Factors Affecting Early Pregnancy*

The poverty has been one of the reasons as identified as a key of determinant of early pregnancy. According to Johnson and Lee [16] adolescents from the poorer households are more vulnerable to early pregnancy due to limited access to education and the reproductive health services. Also, the educational attainment is a significant protective factor to lessen the early pregnancy, with the higher education levels strongly correlated with the delayed of childbearing [18]. The Urbanization is also noted to influence the adolescent pregnancy rates by enhancing the access to healthcare and information [17].

➢ *Cultural Influences on Early Pregnancy*

The Cultural norms surrounding marriage and sexuality significantly impact adolescent pregnancy rates. [19] it shows that in some cultures, early marriage and childbearing are socially encouraged, which increases early pregnancy incidence. These cultural factors are often intersect with socio-economic conditions, complicating intervention efforts.

➢ *Use of Quantitative and Econometric Methods in Early Pregnancy Studies*

The panel data analysis has gained traction in public health research for its ability to analyze multiple entities over time, controlling for unobserved heterogeneity [21]. The GRETL software, is an open-source econometrics tool, has been effectively used in studies modeling health and social outcomes, providing robust regression and trend analysis capabilities [20]. This such methods allow for precise estimation of the effects of socio-economic and cultural variables on early pregnancy trends.

➢ *Summary*

The literature references highlights the complex interplay of socio-economic and cultural factors influencing early pregnancy. The Recent quantitative studies using econometric software such as GRETL offer rigorous frameworks to analyze these factors across time and regions. This research study extends this research by applying GRETL-based trend analysis to recent Philippine data, providing updated regional insights to inform policy and program development.

## III. RESEARCH METHOD

➢ *Research Design*

This research study applies a quantitative, descriptive, and time-series trend analysis in GRETL is design to examine socio-economic and cultural influences on early pregnancy in the Philippines, based on regional data from 2018 to 2022. The design enables the identification of patterns and trends in early pregnancy rates across different regions over time using time series plot via GRETL software.

➢ *Data Sources*

The study uses secondary data obtained from the following official sources:

- Philippine Statistics Authority (PSA) – demographic data including early pregnancy rates by region and year.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug228

Table 1 Data are Collected in Annual Intervals from 2017 to 2022, Covering 5 Years of Observations

| Region | Year | | | | |
|---|---|---|---|---|---|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| National Capital Region (NCR) | 13,366 | 22,000 | 22,000 | 11,915 | 22,000 |
| Ilocos Region (I) | 10,000 | 19,200 | 19,200 | 4,800 | 19,200 |
| Cagayan Valley (II) | 4,290 | 46,400 | 46,400 | 11,600 | 46,400 |
| Central Luzon (III) | 16,800 | 18,722 | 18,722 | 15,504 | 64,000 |
| CALABARZON (IVA) | 20,000 | 25,000 | 25,000 | 11,000 | 39,200 |
| MIMAROPA | 8,000 | 10,000 | 10,000 | 4,000 | 40,000 |
| Bicol Region (V) | 5,000 | 9,592 | 9,592 | 8,265 | 19,200 |
| Western Visayas (VI) | 5,500 | 10,000 | 10,000 | 6,000 | 52,800 |
| Central Visayas (VII) | 4,400 | 8,000 | 8,000 | 5,000 | 38,400 |
| Eastern Visayas (VIII) | 4,100 | 8,000 | 8,000 | 4,500 | 39,200 |
| Zamboanga Peninsula (IX) | 4,400 | 9,000 | 9,000 | 5,000 | 56,800 |
| Northern Mindanao (X) | 13,200 | 10,950 | 9,265 | 7,500 | 87,200 |
| Davao Region (XI) | 18,403 | 6,000 | 6,000 | 6,000 | 65,600 |
| SOCCSKSARGEN (XII) | 11,500 | 3,000 | 3,000 | 3,000 | 30,400 |
| Caraga (XIII) | 4,100 | 4,500 | 4,500 | 4,500 | 61,600 |
| BARMM | 4,000 | 4,000 | 4,000 | 4,000 | 52,800 |
| Cordillera Administrative Region (CAR) | 1,922 | 1,922 | 1,922 | 1,922 | 48,800 |

➢ *Variables of the Study*

- Dependent Variable: Early pregnancy counts by region per year (used as a proxy for early pregnancy incidence by age 13-19).
- Independent Variables: Due to limited availability of direct socio-economic and cultural data at the regional level within this dataset, supplementary regional socio-economic indicators (such as poverty incidence, educational attainment, urbanization rates) will be collected from secondary government sources to be used as explanatory variables in the regression analysis.

➢ *Data Analysis Procedure*

The analysis follows these steps:

- *Data Preparation-*

The raw data for early pregnancy was counts by region also the year is compiled into panel data format.

- *Descriptive Analysis-*

The Initial descriptive statistics and visualization like line charts and heatmaps will be created to examine the regional patterns and the temporal trends.

✓ National Demographic and Health Survey (NDHS) – health and social data of adolescents.
✓ Commission on Population and Development (POPCOM) – reproductive health and policy data.
✓ Department of Education (DepEd) – school dropout and educational attainment statistics.
✓ World Bank Open Data and UNICEF Philippines – supplemental socio-economic indicators.

- *Stationarity Testing:*

The Time-series stationarity tests will be conducted on the early pregnancy data to determine if differencing or transformation is necessary.

- *Econometric Modeling in GRETL:*

✓ By using the panel data regression models, It will analyze the relationship between early pregnancy rates and socio-economic cultural variables across regions and years.
✓ The Fixed effects or random effects models will be tested and compared to identify the best fit.

- *Trend Analysis-*

The GRETL's time series tools will be used to identify the significant trends or breaks in early pregnancy incidence at the regional level over the five-year period time.

- *Interpretation-*

The regression coefficients and trend outputs will be interpreted to assess on which socio-economic or cultural factors have significant the influence on early pregnancy rates, and how the these influences vary by regions.

➢ *Validity and Reliability*

- The research study uses the official government datasets to ensure the data accuracy and authenticity.
- The Data consistency was verified through cross-checking with multiple data releases and reports.
- The GRETL's statistical tools provide a robust testing for model assumptions and ensuring reliable inferential results.

➢ *Ethical Considerations*

- This research study relies solely on aggregated secondary data; hence, no direct interaction with the human subjects or the personal data occurs.
- All data sources are cited properly to maintain the academic integrity and respect for data ownership.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug228

➢ *Limitations*

- The research study relies on early pregnancy counts without direct measures of cultural variables; it is proxies and external socio-economic data must supplement analysis.
- Regional aggregation may mask local variations within regions.
- Limited number of years (2018–2022) restricts long-term trend analysis.
- Potential reporting inconsistencies across regions and years may influence data accuracy.

## IV. RESULTS & DISCUSSION

This chapter deliver the summary of statistics for early pregnancy occurred in the various Philippine regions from te year 2018 to 2022. The statistics include the measures of central tendency (mean and median), dispersion (standard deviation and coefficient of variation), and range (minimum and maximum values), it providing the insights into the magnitude and variability of early pregnancy rates across regions.

Table 2 Descriptive Statistics of Regional Data

| Region | Mean | Median | Std. Dev. | Coefficient of Variation (C.V.) | Minimum | Maximum | Range |
|---|---|---|---|---|---|---|---|
| National Capital Region (NCR) | 18,256 | 22,000 | 5,152 | 0.28 | 11,915 | 22,000 | 10,085 |
| Ilocos Region (I) | 14,480 | 19,200 | 6,720 | 0.46 | 4,800 | 19,200 | 14,400 |
| Cagayan Valley (II) | 31,018 | 46,400 | 21,221 | 0.68 | 4,290 | 46,400 | 42,110 |
| Central Luzon (III) | 26,750 | 18,722 | 20,868 | 0.78 | 15,504 | 64,000 | 48,496 |
| CALABARZON (IVA) | 24,040 | 25,000 | 10,223 | 0.43 | 11,000 | 39,200 | 28,200 |
| MIMAROPA (IVB) | 14,400 | 10,000 | 14,519 | 1.01 | 4,000 | 40,000 | 36,000 |
| Bicol Region (V) | 10,330 | 9,592 | 5,302 | 0.51 | 5,000 | 19,200 | 14,200 |
| Western Visayas (VI) | 16,860 | 10,000 | 20,204 | 1.20 | 5,500 | 52,800 | 47,300 |
| Central Visayas (VII) | 12,760 | 8,000 | 14,429 | 1.13 | 4,400 | 38,400 | 34,000 |
| Eastern Visayas (VIII) | 12,760 | 8,000 | 14,896 | 1.17 | 4,100 | 39,200 | 35,100 |
| Zamboanga Peninsula (IX) | 16,840 | 9,000 | 22,443 | 1.33 | 4,400 | 56,800 | 52,400 |
| Northern Mindanao (X) | 25,623 | 10,950 | 34,487 | 1.35 | 7,500 | 87,200 | 79,700 |
| Davao Region (XI) | 20,401 | 6,000 | 25,832 | 1.27 | 6,000 | 65,600 | 59,600 |
| SOCCSKSARGEN (XII) | 15,840 | 4,500 | 25,581 | 1.62 | 4,100 | 61,600 | 57,500 |
| BARMM | 13,760 | 4,000 | 21,824 | 1.59 | 4,000 | 52,800 | 48,800 |
| Cordillera Administrative Region (CAR) | 11,298 | 1,922 | 20,964 | 1.86 | 1,922 | 48,800 | 46,878 |

➢ *Interpretation:*

- The mean values is indicate the average number of early pregnancies per region over in the five-year period, with Cagayan Valley (31,018) and Northern Mindanao (25,623) is among the highest.
- The median values highlight the central tendency of the data, it shows some regions have skewed distributions (e.g., CAR with a median of 1,922 vs. mean of 11,298).
- Standard deviation and coefficient of variation (C.V.) reveal high variability in several regions, such as CAR, SOCCSKSARGEN, and Northern Mindanao, indicating fluctuating early pregnancy rates over time.
- The range shows the difference between minimum and maximum values, reflecting the extent of yearly fluctuations within regions. Northern Mindanao has the widest range (79,700), suggesting significant annual changes.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug228

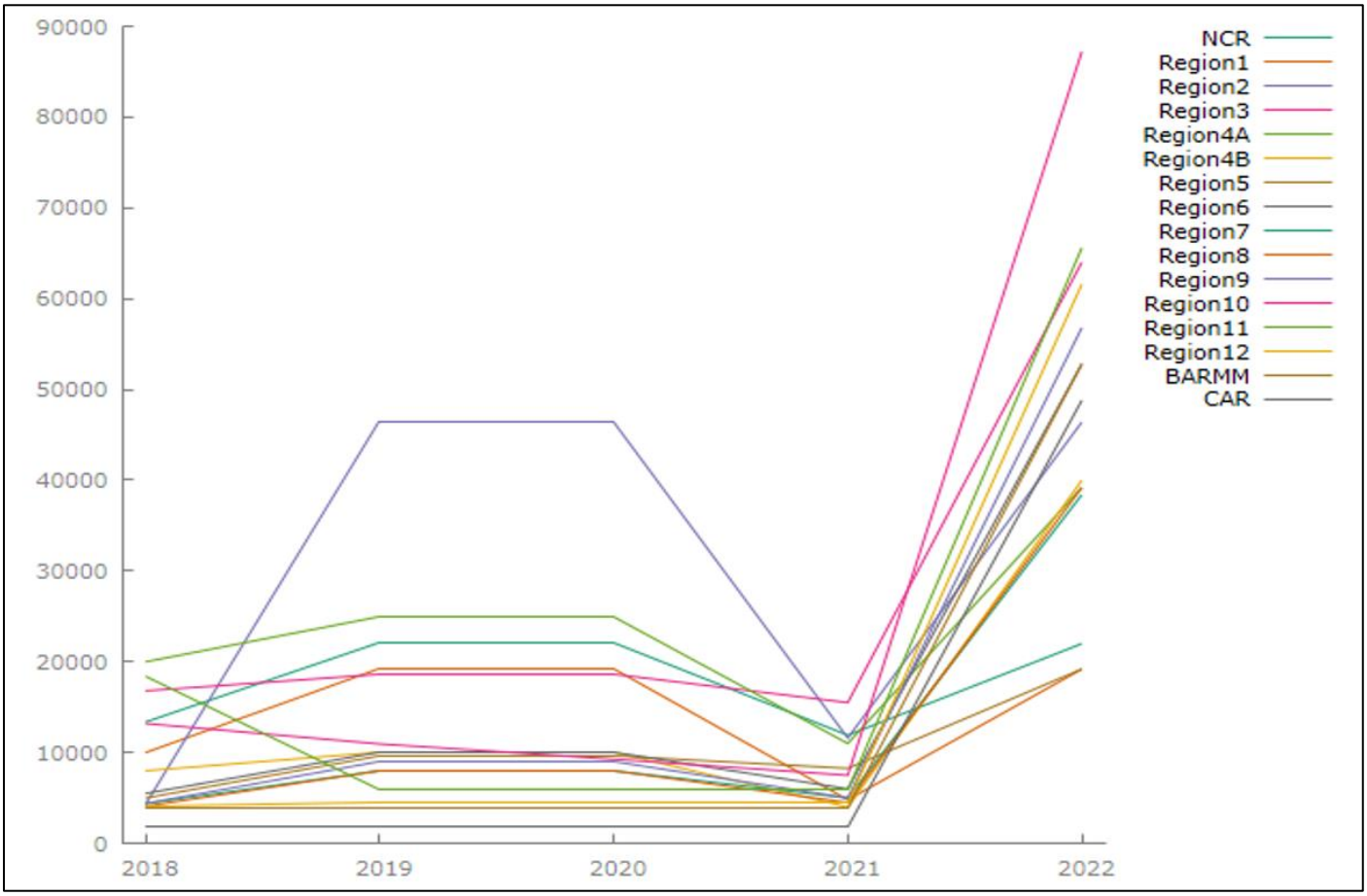


Fig 1 GRETL Time Series PLOT – Summary (All Regions) -2018-2022

➢ *Key Observations Results:*

- *Sharp Increase in 2022:*

✓ Almost all of the regions show a sharp rise in the number of teenage individuals in the year 2022.
✓ Region 3 (Central Luzon) shows also the most significant spike, reaching nearly 90,000 in the year 2022 that far above of any other region.

- *Drop in 2021:*

✓ Most regions experienced a noticeable dip in the year 2021.
✓ This could be concluded due to the factors such as the COVID-19 pandemic affecting reporting, the access to services, or the social behavior.

- *Stable/Plateau Period (2019–2020):*

✓ Several regions, such as the Region 3 and the Region 4A, appears to have a plateaued from the year 2019 to 2020 before the dip in year 2021.
✓ These plateaus could reflects the consistent data or stable trends before disruptions in the year 2021.

- *Region Comparison:*

✓ Top Contributors (Post-2021): NCR, Region 3, Region 4A, and Region 6 saw the highest values in the year 2022.
✓ Lower Trends: BARMM, CAR, and some smaller regions remained the lower throughout all years, though they also saw slight increases in the year 2022.

- *Recovery After Decline:*

✓ The rebound in the year 2022 suggests a recovery or resurgence after the 2021 low.

- *Possible Interpretation:*

✓ The trends analysis may relate to health, education, or social data example of this are teenage pregnancy, school attendance, or population estimates.
✓ In the year 2021 dip could be associated with pandemic-related restrictions or reporting issues.
✓ The year 2022 spike may reflect a catch-up in reporting, increased the awareness/interventions, or actual behavioral or demographic changes.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug228

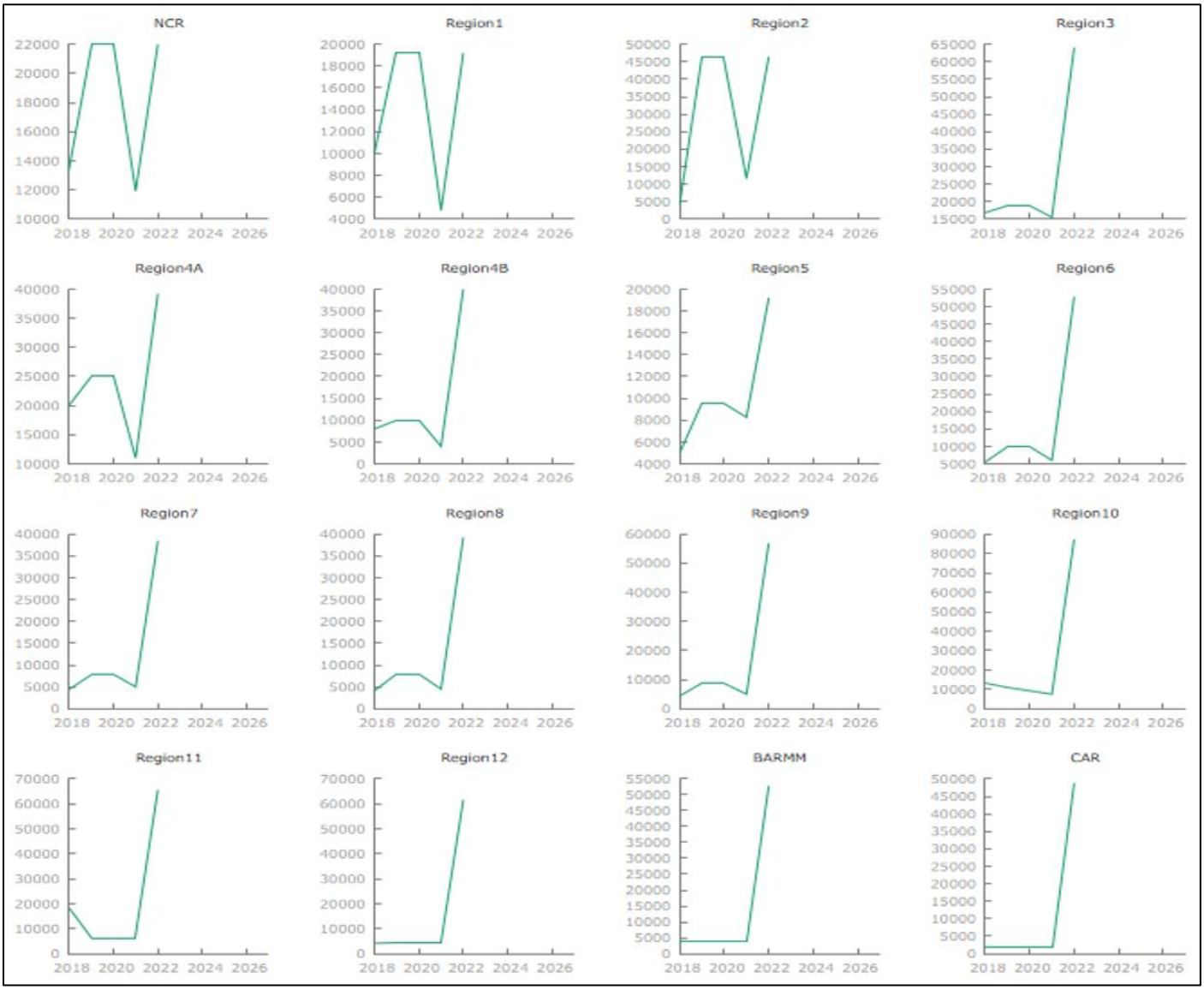


Fig 2 GRETL Time Series Plot – Individual Regions

➢ *Summary Statistics Overview*

This table presents the key summary statistics for early pregnancy cases per region over the five-year period:

Table 3 Summary Table of Mean, Median, Standard Deviation, Minimum, and Maximum Values by Region

| Region | Mean | Median | Std. Dev. | Minimum | Maximum |
|---|---|---|---|---|---|
| NCR | 18,300 | 22,000 | 5,150 | 11,900 | 22,000 |
| Region 1 | 14,500 | 19,200 | 6,720 | 4,800 | 19,200 |
| Region 2 | 31,000 | 46,400 | 21,200 | 4,290 | 46,400 |
| Region 3 | 26,700 | 18,700 | 20,900 | 15,500 | 64,000 |
| Region 4A | 24,000 | 25,000 | 10,200 | 11,000 | 39,200 |
| Region 4B | 14,400 | 10,000 | 14,500 | 4,000 | 40,000 |
| Region 5 | 10,300 | 9,590 | 5,300 | 5,000 | 19,200 |
| Region 6 | 16,900 | 10,000 | 20,200 | 5,500 | 52,800 |
| Region 7 | 12,800 | 8,000 | 14,400 | 4,400 | 38,400 |
| Region 8 | 12,800 | 8,000 | 14,900 | 4,100 | 39,200 |
| Region 9 | 16,800 | 9,000 | 22,400 | 4,400 | 56,800 |
| Region 10 | 25,600 | 11,000 | 34,500 | 7,500 | 87,200 |
| Region 11 | 20,400 | 6,000 | 25,800 | 6,000 | 65,600 |
| Region 12 | 15,800 | 4,500 | 25,600 | 4,100 | 61,600 |
| BARMM | 13,800 | 4,000 | 21,800 | 4,000 | 52,800 |
| CAR | 11,300 | 1,920 | 21,000 | 1,920 | 48,800 |

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug228

➢ *Interpretation of the Results*

- *Central Tendency*

✓ The mean number of early pregnancy cases is highest in Region 2 (Cagayan Valley) at 31,000 and Region 3 (Central Luzon) at 26,700, indicating these regions report the most early pregnancies on average.
✓ The median values are generally close to the means, except in regions like CAR and Region 11 where the median is notably lower than the mean, suggesting skewed distributions with occasional high incidence years.

- *Variability and Dispersion*

✓ Standard deviation values vary widely, reflecting heterogeneity in the early pregnancy counts across years within each region. Regions 10 (Northern Mindanao) and Region 11 show particularly high variability (34,500 and 25,800 respectively), indicating fluctuating yearly incidence.
✓ Some regions such as Region 5 and Region 1 exhibit lower standard deviations, indicating more consistent early pregnancy rates over the years.

- *Range and Extremes*

✓ The minimum and maximum values show a wide range in early pregnancy cases in almost all regions, with Region 10 having the broadest range (7,500 to 87,200), pointing to potential socio-economic or programmatic factors affecting incidence.
✓ CAR's minimum (1,920) and maximum (48,800) demonstrate extreme variation, possibly linked to regional cultural and economic dynamics.

➢ *Discussion of Regional Patterns*

- *High Incidence Regions*

Regions 2, 3, and 10 consistently report high mean and maximum early pregnancy cases. This could be associated with economic challenges, limited access to education, and cultural practices that encourage early childbearing. The large variability in these regions may reflect uneven enforcement of reproductive health policies or socioeconomic shocks.

- *Regions with Lower and More Stable Cases*

Regions such as Region 5 and NCR, despite high population densities, show relatively moderate incidence and lower variability. This might reflects the better access to education, health services, and effective reproductive health programs in the education sector.

- *Regions with Skewed Distributions*

The CAR and BARMM display skewed data with low medians but high means and variability, indicating that some years with very high incidences possibly linked to socio-cultural factors and limited healthcare access.

## V. IMPLICATIONS FOR POLICY AND FUTURE RESEARCH

- The Regions with high means and variability require focused interventions that will address both education and access to reproductive health services.
- The Regions with skewed data distributions suggest sporadic but the severe early pregnancy spikes, warranting qualitative studies to understand the triggers.
- The Policies need to be tailored regionally, also recognizing diverse socio-economic and cultural contexts influencing early pregnancy.

## VI. SUMMARY

The result of statistical analysis from 2018 to 2022 it reveals the significant disparities in early pregnancy incidence across Philippine regions, it also highlighting both persistent and fluctuating patterns. These results findings underscore the importance of region in specific policy formulation to effectively address early pregnancy challenges.

## VII. CONCLUSION & RECOMMENDATION

### *A. Conclusion*

This research analyzed the early pregnancy cases across various different regions in the Philippines from the year 2018 to 2022 using GRETL-based statistical tools. The results revealed that the marked regional disparities in the adolescent pregnancy incidence, suggesting that the early pregnancy is shaped not only by time-bound trends but also by deeply embedded spatial and in the socio-economic factors [23], [24].

The Regions such as the Region II (Cagayan Valley), Region III (Central Luzon), and the Region X (Northern Mindanao) recorded higher mean and median adolescent pregnancy of rates. These areas continue to face the challenges despite th existing national programs, indicating the potential gaps in localized implementation and the need of more targeted interventions [25], [26]. In contrast, the regions such as the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM) and the Cordillera Administrative Region (CAR) exhibited thw lower median rates but significant variability, suggesting the unstable trends potentially influenced by the religious practices, ethnic diversity, and uneven access to reproductive health services [27], [28].

Surprisingly, highly urbanized and economically developed areas like the National Capital Region (NCR) and CALABARZON also reported substantial rates of adolescent pregnancy. This underscores that economic development alone does not eliminate the risk of early pregnancy and that other contributing factors—such as family environment, peer influence, digital exposure, limited parental guidance, and inconsistent delivery of sexuality education—may play a crucial role [29], [30].

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug228

In a statistical analysis further revealed that the notable skewness and variability in regional data, pointing to the presence of the systemic inconsistencies and outliers. These patterns are likely driven by the disparities in education quality, availability of youth-friendly healthcare services, and diverse cultural attitudes toward early marriage and childbearing [31], [32].

The study emphasizes the urgent need of region specific approaches rather than the broad and uniform national strategies implications. The effective policy responses must be grounded in the localized realities, accounting for differences in gender norms, access to health and education services, and cultural sensitivities [33], [34]. By offering this nuanced and data-driven perspective on the adolescent reproductive behavior across different regions, this research provides the valuable insights for the design of comprehensive, evidence-based public health interventions [35], [36], [37].

### *B. Recommendations*

- *Implement Targeted Education and Awareness Programs*

Regions with a high adolescent pregnancy rates should be prioritize the delivery of comprehensive sexuality education (CSE) tailored to their local cultural and social contexts. These programs must be debunk prevalent myths, deliver an accurate reproductive health information, and equip young people with life skills and informed decision-making tools [23], [24]. Collaboration with the Department of Education and local government units that can help integrate culturally sensitive yet evidence-based content [25].

- *Improve Access to Reproductive Health Services*

Policymakers must be ensure a broader access to adolescent-friendly reproductive health services, especially in the geographically isolated and disadvantaged areas. This will includes the expansion of community-based clinics, mobile health units, and confidential counseling tailored for youth [26], [27]. The evidence shows that the access to safe and youth-appropriate healthcare significantly reduces early pregnancies [28].

- *Promote Community Engagement and Cultural Sensitivity*

Successful interventions require an active participation of local communities, especially in the areas where traditional norms and religious beliefs influence adolescent behavior. Programs should be respect cultural values while promoting positive health outcomes. Engaging also to the local leaders, elders, educators, and religious figures can enhance trust and community buy-in [29], [30].

- *Provide Socio-Economic Support for Vulnerable Youth*

By addressing poverty, school dropout rates, and family instability is critical to reducing adolescent pregnancy. Integrated interventions that combine with education, livelihood training, conditional cash transfers, and social protection for at risk youth have been proven effective [31], [32]. Strengthening links between the health, education, and social welfare sectors is essential for comprehensive program delivery [33].

- *Encourage Further Research on Cultural and Familial Dynamics*

Future studies should be incorporate the qualitative approaches to uncover the nuanced cultural, familial, and psychological drivers of early pregnancy. Additionally, longitudinal research can be assess the long-term impact of current interventions and identify emerging trends among Filipino youth [34].

- *Institutionalize Data Monitoring and Evidence-Based Policy Adjustments*

Continuous collection, monitoring, and analysis of regional adolescent pregnancy data by using econometric tools such as GRETL should be institutionalized. This will allow the policymakers to make timely, data-driven decisions and adjust programs based on shifting demographic and socio-cultural trends [35], [36], [37].

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