

## Moderating Role of Health Services and Personnel on the Relationship between Education, Income, and Crude Birth Rate in Bogor Regency, Indonesia

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**Abstract:** This study examined the factors that influence the crude birth rate (CBR) in Bogor Regency, Indonesia. The study objectives were to (1) determine the relationship between education and CBR, (2) determine the relationship between income and CBR, and (3) determine the moderating effect of healthcare services and personnel on the relationship between education and CBR. A cross-sectional survey was conducted with a sample of 259 respondents. The data were collected using a structured questionnaire. The data were analyzed using descriptive statistics, regression analysis, and moderating effect analysis. The results show that education and income have a significant impact on CBR. However, income has a non-linear relationship. Higher income can lower the CBR in the Bogor district. Health services can moderate the relationship between education and CBR. The findings of this study suggest that education and income are important factors that influence CBR in Bogor Regency.

**Keywords:** CBR; Government's Policy; Moderated Regression Analysis

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## INTRODUCTION

Population is one of the main factors in economic growth. High population growth can make a country poor (Ashraf et al., 2013). The classical Malthusian theory states that increasing income affects population growth and fertility rates, increasing poverty (Simon, 2018). Three main factors of population dynamics influence population growth in a region: fertility, mortality, and migration. Birth is a determinant of fertility value, where birth is the ability of a woman to give birth, which is reflected in the number of babies born. The relationship between birth rates and economic growth is crucial in determining economic policy for macroeconomic development. Reproductive behavior is critical in determining the relationship between birth rates and the economy (Goldstein et al., 2013).

The birth rate in Indonesia has been consistently decreasing. According to information provided by the Central Bureau of Statistics, this decline has been occurring for decades. In addition, the data shows that the birth rate in Bogor Regency has also been declining from year to year. Following the local regulation, PERDA Bogor Regency Number 3, the Year 2021, the Crude

Birth Rate Index (CBR) target at the end of the specified period is set at 18.21, representing a decrease of 6.59% within five years. Analysis of data from the Bogor District Health Office and Bogor District Central Bureau of Statistics shows that the CBR in 2022 was 14.60, falling into the "low" category and successfully meeting the set target. Several factors, such as education and income, have been identified as contributing factors to this decline in several studies. However, the outcomes of government policies also have an impact on the birth rate. However, there is still a need to study what indicators influence the birth rate, such as the number of existing healthcare facilities and personal resources.

The relationship between population and economic growth is a captivating puzzle (Cygan-Rehm & Maeder, 2013). While some argue high birth rates fuel prosperity, others warn of poverty and resource strain (Choi, 2022). Here in Bogor Regency, Indonesia, the birth rate has been steadily declining, mirroring trends in developed nations. This fascinating phenomenon compels us to delve deeper. While education and income are often cited as driving forces behind declining birth rates, the impact of government policies and healthcare access remains less explored (Salvati et al., 2020). This article seeks to illuminate this gap in our understanding.

This research investigates the intricate relationship between socioeconomic factors, healthcare access, and birth rates in Bogor Regency, Indonesia. While previous studies have explored the influence of government intervention (Chen & Guo, 2022) and the challenges of population decline (Salvati et al., 2020), the impact of socioeconomic factors remains debated. Some studies find a positive link between birth rates and economic growth (Ashraf et al., 2013; Kehinde Ogunbadejo et al., 2021), while others suggest a negative correlation (Tartiyus et al., 2015) or no significant impact (Okwori et al., 2015). This ambiguity highlights the need for further research, particularly within the specific context of Bogor Regency. The novelty of this research lies in examining how health services and personnel moderate the established relationships between education, income, and the crude birth rate (CBR). By investigating this interplay, we aim to uncover novel insights and contribute valuable knowledge to the existing body of research.

## **LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT**

Research on the relationship between education and CBR is diverse. Many findings suggest a decline in CBR in developing countries due to direct education (Ali & Gurmu, 2018; Godefroy & Lewis, 2018; Ozier, 2018) and indirect education. Ozbay Das (2020) found a significant decrease in birth rates following the implementation of the compulsory education policy in Turkey. High educational attainment can make individuals busy, reducing their likelihood of having children (Samari, 2019). Pursuing higher education takes time, which prolongs the age of marriage and delays childbirth (Oktavia et al., 2014; Putri & Yasa, 2016). However, it has been found that women with higher education can increase birth rates (Radovich et al., 2018). Women with higher education who lack employment tend to have children earlier, increasing birth rates.

The relative income theory by Easterlin (1975) is one theory that influences fertility. The demand for children is directly determined by income. The family's ability to meet the household's needs, especially those with children, is influenced by income levels (Rainey et al., 2011). Higher income is better able to meet the financial costs associated with having children, resulting in a higher likelihood of live births. Nyoni (2018) found that income is a determining factor in population growth. Evidence from the pandemic shows a negative impact on CBR in various countries (Aassve et al., 2021). The pandemic conditions have reduced their income levels, affecting their ability to meet their needs and leading to a decline in birth rates. These findings are consistent with the study by Kehinde Ogunbadejo et al. (2021), which found a significant positive relationship between income and birth rates.

Another factor influencing the birth rate is access to healthcare services near residential areas. Difficulties in accessing healthcare services for pregnant women can lead to maternal and infant mortality. The lack of healthcare facilities influences complications during pregnancy and childbirth. The accessibility of healthcare services in Indonesia remains problematic due to significant demographic differences between regions. While there are adequate healthcare facilities in Indonesia, their distribution could be more evenly spread, particularly in remote

areas. Accessibility to healthcare services becomes crucial when complications arise during childbirth, requiring prompt intervention to avoid health risks and mortality. A study found that healthcare facilities are more utilized by women with higher education. Mothers with a better understanding of pregnancy danger signs are more likely to use healthcare facilities. In addition to healthcare facilities, the role of healthcare professionals has been proven to reduce maternal mortality. Skilled healthcare professionals are needed during childbirth to reduce infant mortality rates. Infant mortality rates harm the growth of the birth rate. Therefore, healthcare professionals indirectly influence the growth of the birth rate. This study utilizes data on the number of community health centers to measure healthcare facility variables and the number of midwives as a measurement of healthcare professional variables in each district of Bogor Regency.

Another factor influencing the birth rate is access to healthcare services near residential areas. Difficulties in accessing healthcare services for pregnant women can lead to maternal and infant mortality. Andriyani et al. (2020) found that the lack of healthcare facilities influences complications during pregnancy and childbirth. Megatsari et al. (2018) also reported that the accessibility of healthcare services in Indonesia remains problematic due to significant demographic differences between regions. While there are adequate healthcare facilities in Indonesia, their distribution could be more evenly spread, particularly in remote areas. Bailey et al. (2009) found that access to healthcare services becomes crucial when complications arise during childbirth, requiring prompt intervention to avoid health risks and mortality.

A study by Laksono and Wulandari (2022) found that healthcare facilities are more utilized by women with higher education. Mothers with a better understanding of pregnancy danger signs are more likely to use healthcare facilities. In addition to healthcare facilities, the role of healthcare professionals has been proven to reduce maternal mortality (Chasanah, 2017). Carlough and McCall (2005) also found that skilled healthcare professionals are needed during childbirth to reduce infant mortality rates. Infant mortality rates harm the growth of the birth rate. Therefore, healthcare professionals indirectly influence the growth of the birth rate. This study utilizes data on the number of community health centers to measure healthcare facility variables and the number of midwives as a measurement of healthcare professional variables in each district of Bogor Regency.

Based on the Literature Review and Hypothesis Development, the research model is shown in Figure 1.

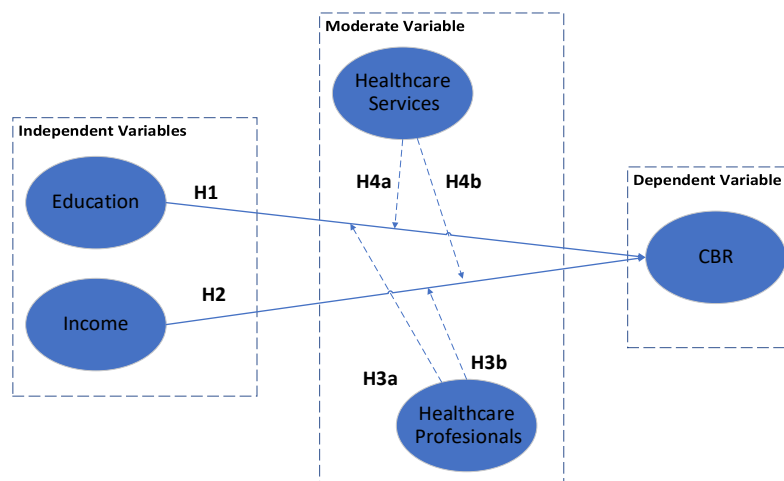


Figure 1. Research Model

H1: Education influences CBR.

H2: Income influences CBR.

H3a: Healthcare services moderate the influence of education on CBR.

H3b: Healthcare services moderate the influence of income on CBR.

H4a: Healthcare professionals moderate the influence of education on CBR.

H4b: Healthcare professionals moderate the influence of income on CBR.

## RESEARCH METHOD

This study uses quantitative methods to examine the factors that influence the crude birth rate (CBR) in Bogor Regency, Indonesia. The research design will be described in Figure 2.

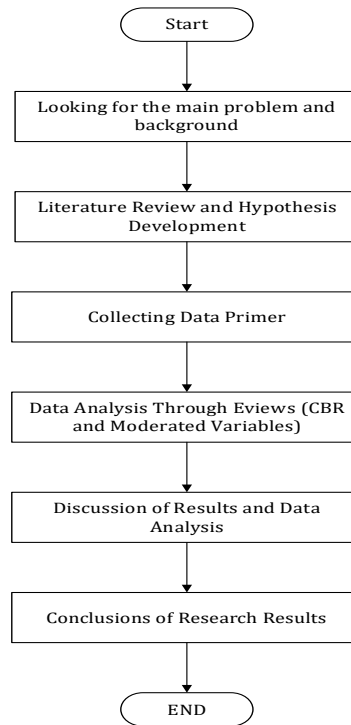


Figure 2. Research Design

This study employed questionnaires and documentation as the primary methods for data collection. Data analysis was conducted through data interpretation, supplemented by the use of a statistical application called Eviews. The utilization of Eviews served to minimize calculation errors when determining the percentage of primary data recapitulation and facilitated the presentation of processed data results. The sampling technique employed in this study was cluster random sampling. The sample size, determined using the Slovin formula with a 10% margin of error based on Isaac and Michael's table, consisted of 269 individuals representing 40 sub districts in the district of Bogor Regency, Indonesia.

### Crude Birth Rate (CBR)

Crude Birth Rate (CBR) is a measure that indicates the number of live births per 1,000 people during one year (Dyson, 2010). This rate is considered "crude" because it does not consider the population's gender, age distribution, or age above 50 years.

The formula to calculate the Crude Birth Rate is as follows:

$$CBR = (L/P) \times 1000$$

Where:

CBR = Crude Birth Rate

L = number of live births during one year

P = population in a given year

The policy focus of Bogor Regency is to increase the decrease of CBR, which requires information on the distribution of CBR per district. The population projection data in 2022 per district was obtained using the geometric model formula based on population data by sex and district (souls) from BPS Bogor Regency in 2016-2021. (Source Url:

<https://bogorkab.bps.go.id/indicator/12/29/2/penduduk-menurut-jenis-kelamin-dankecamatan.html>). Data on the childbirth of women in Bogor Regency was obtained from the Health Office of Bogor Regency (Linakes and Midwives) for data in 2022, and it is data from January to September 2022. The Geometric Model formula for calculating the percentage of population growth can be calculated using the following equation:

$$r = \left(\frac{P_t}{P_o}\right)^{\frac{1}{t}} - 1 \quad (1)$$

Furthermore, to calculate the growth prediction can be computed using the following formula:

$$P_t = P_o(1 + r)^t \quad (2)$$

Where:

r = population growth rate (%)

P<sub>t</sub> = population in year t

P<sub>o</sub> = population in the base year

t = period (difference)

### Moderated Variables

Moderated Regression Analysis (MRA) is conducted to examine the influence of healthcare services on the relationship between Education and Income with Crude Birth Rate (CBR). Health centers (*puskesmas*) and midwives (*bidan*) are moderating variables between Education and CBR, as well as Income and CBR. One-way testing is applied in this research hypothesis to examine the influence of independent variables on the dependent variable using a significance level of 10%.

In this research model, health centers and midwives serve as moderating variables that mediate the relationship between education and income toward the Crude Birth Rate (CBR). Moderating variables can weaken or strengthen the relationship between exogenous and endogenous variables. According to Sharma, Durand, and Gur-Arie (1981), there are four types of moderation: (1) Pure moderation is a variable that moderates the relationship between independent and dependent variables, where the pure moderating variable interacts with the independent variable without becoming an independent variable itself; (2) Quasi moderation is a variable that moderates the relationship between independent and dependent variables, where the quasi moderating variable interacts with the independent variable and also becomes an independent variable; (3) Homologizer moderation is a potential moderating variable that affects the strength of the relationship between independent and dependent variables. This variable does not interact with the independent variable and has no significant relationship with the dependent variable; (4) Predictor moderator is a moderating variable that only acts as an independent variable in the formed relationship model.

## RESULTS AND DISCUSSION

### Descriptive Tests

The characteristics of 259 respondents from 40 sub districts of Bogor district tested descriptively in this study include gender, age, married status, education, occupation, working hours, income, and number of family members. The age category used in this study refers to WHO, which classifies adolescents (11-19 years), adults (20-60 years), and the elderly (more than 60 years). Respondent's income was categorized based on the value of the Bogor Regency Minimum Wage (UMK) of 4,217,206 as stipulated in the Decree of the Governor of West Java Number: 561/Kep.732-Kesra/ 2021, with categories below UMK (<4,217,206) and above UMK (>4,217,206).

The average age of survey respondents is 37.06 years old, categorized as adults. Male respondents dominate the study (75.9%). The largest marital status category is married (81.1%). Regarding education, respondents are mostly graduates of D2/D2/D3 (55.8%) and Master's degrees (25.6%). Many respondents chose "other" as their occupation category (45.4%). Most respondents work 8 hours per day (65.2%), and their income is less than the regional minimum wage (68.3%).

This study uses a questionnaire measurement of education, income, and CBR on a scale of 1-3. The education variable is divided into three categories: (1) primary school and below, (2)

high school, and (3) bachelor's degree and above. The income variable is divided into three categories: (1) below the minimum wage, (2) equal to the minimum wage, and (3) above the minimum wage. The CBR variable is divided into three categories based on the minimum and maximum values obtained: (1) below 12.36, (2) between 12.36 and 15.53, and (3) above 15.53. The *Puskesmas* variable is based on the availability of health service units, and the *bidan* variable is based on the number of healthcare professionals in each district within Bogor Regency.

**Table 1.** Descriptive Statistics of Education, Income, CBR, *Puskesmas*, and *Bidan* Variables

	EDUCATION	INCOME	CBR	PUSKESMAS	MIDWIFE
Mean	2.13	1.52	2.29	2.81	28.06
Median	2.00	2.00	2.00	3.00	29.00
Maximum	3.00	2.00	3.00	5.00	45.00
Minimum	1.00	1.00	1.00	1.00	13.00
Std. Dev.	0.42	0.50	0.58	0.83	7.469
Skewness	0.78	-0.06	-0.13	0.37	0.123
Kurtosis	4.64	1.00	2.43	3.29	2.729
Jarque-Bera	6.69	5.16	0.51	0.82	0.173
Probability	0.03	0.07	0.77	0.66	0.916
Sum	66.0	47.0	71.0	87.0	870.0
Sum Sq. Dev.	5.48	7.74	1.03	20.8	1673.8
Observations	31	31	31	31	31

### Results of CBR Analysis in Bogor Regency 2022

The calculated value of CBR for the year 2022 is lower than the calculation for 2021. According to the 2021 report, the projected CBR target was 19.19. However, due to the lower population count based on the 2021 population census compared to the projection (5,489,536 vs. 5,497,338), the CBR index for 2021 was 16.66. Meanwhile, the CBR value for the year 2022 is 14.60, which means that although it is below the set target of CBR 18.65, it falls into the "low" category (less than 20.00).

**Table 2.** Index CBR in Bogor Regency 2022

No.	District	Percentage Growth of Population from 2016 to 2021	Projected Population in 2022	Number of Births in 2022	CBR
1	Nanggung	2.83%	102641	1482	14.4
2	Leuwiliang	0.75%	126493	2361	18.7
3	Leuwisadeng	1.01%	78655	1030	13.1
4	Pamijahan	2.50%	163209	2213	13.6
5	Cibungbulang	2.16%	150747	1418	9.4
6	Ciampea	1.43%	172644	1581	9.2
7	Tenjolaya	1.99%	65707	1719	26.2
8	Dramaga	0.25%	111394	1846	16.6
9	Ciomas	-0.47%	171526	2475	14.4
10	Tamansari	1.48%	112112	1792	16.0
11	Cijeruk	1.44%	94174	1333	14.2
12	Cigombong	-0.55%	97847	1416	14.5
13	Caringin	1.35%	134273	2027	15.1
14	Ciawi	0.09%	115916	1542	13.3
15	Cisarua	0.91%	129472	1822	14.1
16	Megamendung	0.39%	108367	1678	15.5
17	Sukaraja	0.67%	210826	3085	14.6
18	Babakan Madang	-0.97%	114450	1788	15.6
19	Sukamakmur	1.86%	88138	1195	13.6
20	Cariu	2.51%	53371	614	11.5
21	Tanjungsari	2.23%	58915	700	11.9
22	Jonggol	0.01%	145416	2249	15.5
23	Cileungsi	-2.63%	284469	4590	16.1

**Table 2.** Index CBR in Bogor Regency 2022 (cont')

No.	District	Percentage Growth of Population from 2016 to 2021	Projected Population in 2022	Number of Births in 2022	CBR
24	Kelapa Nunggal	2.05%	133706	1957	14.6
25	Gunung Putri	-6.88%	280665	4617	16.5
26	Citeureup	-1.05%	213550	3568	16.7
27	Cibinong	-2.50%	357232	5826	16.3
28	Bojong Gede	-1.87%	286999	4234	14.8
29	Tajur Halang	0.96%	127306	1956	15.4
30	Kemang	-0.54%	105361	1454	13.8
31	Ranca Bungur	2.87%	63507	841	13.2
32	Parung	-2.30%	121027	1985	16.4
33	Ciseeng	-0.04%	111582	1605	14.4
34	Gunung Sindur	0.25%	129491	2116	16.3
35	Rumpin	1.23%	149241	1919	12.9
36	Cigudeg	1.67%	137639	2032	14.8
37	Sukajaya	3.35%	70264	900	12.8
38	Jasinga	2.26%	109923	1459	13.3
39	Tenjo	0.85%	74473	994	13.3
40	Parung Panjang	-1.63%	116791	1874	16.0
41	<b>Kab. Bogor</b>				<b>14.60</b>

Based on the CBR index per district for the year 2022, it is found that the lowest CBR is in Ciampea District, and the highest CBR is in Leuwiliang District. There are 16 districts with a CBR lower than the CBR of Bogor Regency, which is 14.60 in 2022. Additionally, there are 15 districts with a higher CBR than the regency's CBR. The results mean that almost half of all districts in Bogor Regency in 2022 are already classified as "low" in terms of CBR.

### Hypothesis Test

Hypothesis testing using regression analysis is conducted to obtain a linear equation by assuming a linear relationship between the dependent and independent variables. Each coefficient indicates the extent to which changes in the independent variable will affect the dependent variable. The results of the regression analysis are shown in Table 3.

**Table 3.** Regression Testing

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	2.026	0.564108	3.592.182	0.00
Education	0.402	0.239361	1.678.898	0.10
Income	-0.390	0.201452	-1.937.063	0.06

The linear equation from the regression analysis results above can be written as follows:

$$CBR = 2.026 + 0.402 * X1 - 0.390 * X2$$

Where:

CBR is the dependent variable (the target or the output to be predicted), X1 is the first independent variable (Education), and X2 is the second independent variable (Income).

The Coefficients associated with each independent variable (Education and Income) are:

The coefficient 2.026 is the coefficient for the constant variable (C), The coefficient 0.402 is the coefficient for the education variable, and the coefficient -0.390 is the coefficient for the income variable.

### H1: The Relationship Between Education and Crude Birth Rate

The first hypothesis test regarding the relationship between education level and crude birth rate can be seen from the probability value in Table 1, where the significance level used in this study is 10%. The probability result for education in the test is 0.10, equal to the significance level of 0.1. Therefore, the first hypothesis in this study is accepted, indicating a significant influence between education level and CBR. There is a positive relationship between education level and

CBR, as indicated by the coefficient value of education, which is 0.402. Each increase in one education level will increase the growth of the crude birth rate by a factor of 0.402. Conversely, each decrease in one education level will decrease the growth of the crude birth rate by a factor of 0.402.

Based on data from the BPS Census (2020), the population composition shows that 32.44% have completed primary education, 22.33% have completed junior high school, and 31.96% have completed high school, while 7.41% have completed higher education such as diploma, bachelor's, and postgraduate degrees. The remaining 5.87% have not completed primary education. The percentage of the population in Bogor Regency aged >15 years who have completed their education to higher levels is increasing, especially with the implementation of the Pancakarsa Program (Smart Bogor), one of which is in the field of education. This increasing trend is reflected in the rise of the Net Enrollment Ratio (APM) and the Gross Enrollment Ratio (APK) and as follows.

**Table 4.** The Increasing Value Trends of APM and APK in Bogor Regency

Education Level	Net Enrollment Ratio (APM)		Gross Enrollment Ratio (APK)	
	2020	2021	2020	2021
SD/MI/Equivalent	99,11	99,15	104,44	104,64
SMP/MTs/ Equivalent	84,29	85,26	88,11	92,02
SMA/SMK/MA/ Equivalent	53,2	54,66	61,95	64,13

Source: BPS of Bogor Regency, 2022

These findings support previous research (Radovich et al. 2018) that stated education positively impacts fertility growth. The increase in birth rates often occurs among young women with at least a secondary education. The inability to work for highly educated women leads to earlier childbirth, thereby increasing the birth rate.

## H2: The Relationship Between Income and Crude Birth Rate

The second hypothesis testing regarding the relationship between income and crude birth rate can be observed from the probability values in Table 1, where the significance level used in this study is 10%. The probability value for income in the test results is 0.06, below the significance level of 0.1. Therefore, the second hypothesis in this study is accepted, indicating a significant relationship between income and CBR. There is a negative relationship between income level and CBR, as indicated by the coefficient of income, which is -0.39. Each increase in income level will decrease the crude birth rate by a factor of 0.39.

Similarly, each decrease in income level will increase the crude birth rate by a factor of 0.39. The results of the 2022 Bappedalitbang study show that the community's purchasing power in Bogor Regency continues to experience an increase. In 2020, it was only Rp. 10,317,000 per person per year. In 2021, it increased to Rp. 10,410,000 per person per year, and in 2022, it became Rp—10,860,000 per person per year.

These findings support the hypothesis of old-age security (Neher, 1971), which found that lower income encourages the desire to have children. Children are seen as a financial resource for parents in later life. This finding aligns with research studies (Husain, 2022; Kountouris, 2020; Zakaria et al., 2017) that demonstrate that higher income has been proven to reduce fertility. Women's wages within the family resulting from employment can increase household income. Working women have busier schedules, which can decrease the likelihood of having children, affecting the birth rate (Fang et al., 2013). Higher income levels can also delay the age of the first marriage, which is nonlinearly related to the birth rate (Sudibia et al., 2015).

## H3a: Healthcare services moderate the influence of education on CBR.

The testing of whether healthcare services can moderate the relationship between education and CBR can be concluded by conducting two tests on the probability values of the moderating variable (healthcare center) and the interaction between the moderating variable and the independent variable (education) on the dependent variable (CBR). The results of these tests are shown in Table 5 and Table 6. The probability value of the first test for the moderating



variable (healthcare center) with the dependent variable (CBR) is 0.192. This probability value is greater than the significance level of 0.1, indicating no significant influence between healthcare centers and CBR. The probability value of the second test for the interaction between education, healthcare center, and CBR is 0.085. This probability value is smaller than the significance level of 0.1, indicating a significant influence of the interaction between education, healthcare center, and CBR. The results of the two tests indicate the presence of a moderating variable (healthcare center) as a pure moderator. The results mean that the moderating variable (healthcare center) purely moderates the relationship between the independent variable (education) and the dependent variable (CBR). Our findings support hypothesis 3a, which states that education and CBR significantly influence healthcare centers as moderators.

**Table 5.** Test the Influence of *Puskesmas* on CBR

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	1.155	0.617348	1.871	0.071
Education	0.312	0.245229	1.270	0.214
<i>Puskesmas</i>	0.168	0.125800	1.335	0.192

The linear equation from the regression analysis results above can be written as follows:

$$CBR = 1,155 + 0,312 \text{ education} + 0,168 \text{ puskesmas} + e$$

**Table 6.** Test the Interaction Effect of *Puskesmas* and Education on CBR

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	-1.964	1.844	-1.065	0.296
Education	1.797	0.864	2.079	0.047
<i>Puskesmas</i>	1.365	0.681	2.005	0.055
Education* <i>Puskesmas</i>	-0.567	0.317	-1.787	0.085

The linear equation from the regression analysis results above can be written as follows:

$$CBR = -1,964 + 1,797 \text{ education} + 1.365 \text{ puskesmas} - 0,567 \text{ education} * \text{puskesmas} + e$$

Zakaria et al. (2017) stated that the availability of healthcare services can impact birth rates. The improvement of healthcare services can significantly reduce infant and child mortality rates. The decrease in infant and child mortality rates negatively correlates with birth rates. Good healthcare services lower infant mortality rates and improve overall quality of life. The accessibility of healthcare services is also a concern for improving healthcare delivery, given the diverse demographic conditions across different regions in Indonesia (Laksono & Wulandari, 2022). During the decade-long demographic bonus experienced by Bogor Regency, the Infant Mortality Rate (AKB) decreased from 29 per 1000 live births in the 2020 Population Census. The improvement of healthcare facilities and infrastructure through Pancakarsa (Healthy Bogor) has enabled newborns to have a better chance of survival (BPS, 2020). Therefore, the accessibility of healthcare services is a crucial factor to consider concerning infant birth rates.

### H3b: Healthcare services moderate the influence of income on CBR.

The testing of the role of healthcare services in moderating the relationship between income and CBR can be concluded by conducting two tests on the probability values of the moderating variable (*puskesmas*) and the interaction between the moderating variable and the independent variable (income) on the dependent variable (CBR). The results of these tests are presented in Table 7 and Table 8.

**Table 7.** Test the Influence of *Puskesmas* on CBR

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	2.292	0.449819	5.096	0.000
Income	-0.369	0.200669	-1.843	0.075
<i>Puskesmas</i>	0.199	0.122312	1.620	0.100

The linear equation from the regression analysis results above can be written as follows:

$$CBR = 2,292 - 0,369 \text{ income} + 0,199 \text{ puskesmas} + e$$

**Table 8.** Test the Interaction Effect of Puskesmas and Income on CBR

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	1.266	1.068	1.185	0.246
Income	0.382	0.739	0.517	0.608
Puskesmas	0.565	0.367	1.539	0.135
Income*Puskesmas	-0.266	0.252	-1.057	0.299

The linear equation from the regression analysis results above can be written as follows:

$$\text{CBR} = 1,266 + 0,382 \text{ income} + 0,565 \text{ puskesmas} - 0,266 \text{ income} * \text{puskesmas} + e$$

The probability value of the first test for the moderating variable (*puskesmas*) with the dependent variable (CBR) is 0.1. This probability value equals the significance level of 0.1, indicating a significant influence of *puskesmas* on CBR. The probability value of the second test for the interaction between income and *puskesmas* on CBR is 0.299. This probability value is greater than the significance level of 0.1, indicating no significant influence of the interaction between income and *puskesmas* on CBR. The results of the two tests indicate that the moderating variable (*puskesmas*) is a Predictor Moderator.

This result shows that *puskesmas* does not act as a moderator variable but functions as an independent variable or predictor in the developed model. Our findings reject hypothesis 3b, which states a significant influence of income and CBR with *Puskesmas* as a moderator. The existence of *puskesmas* serves, among others, as a facility for facilitating maternal healthcare services, including childbirth, which is less correlated with the community's income aspect.

#### H4a: Healthcare professionals moderate the influence of education on CBR.

The testing of the role of healthcare workers in moderating the relationship between education and CBR can be concluded by conducting two tests on the probability values of the moderating variable (midwife) and the interaction between the moderating variable and the independent variable (education) on the dependent variable (CBR). The results of these tests are presented in Table 9 and Table 10.

**Table 9.** Test the Influence of Education on CBR

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	1.914	0.695	2.752	0.010
Education	0.322	0.250	1.289	0.207
Midwife	-0.011	0.014	-0.774	0.445

The linear equation from the regression analysis results above can be written as follows:

$$\text{CBR} = 1,914 + 0,322 \text{ education} - 0,011 \text{ midwife} + e$$

**Table 10.** Test the Interaction Effect of Education and Midwife on CBR

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	1.539	2.400	0.641	0.526
Education	0.498	1.101	0.452	0.654
Midwife	0.003	0.089	0.038	0.969
Education * Midwife	-0.006	0.041	-0.163	0.871

The linear equation from the regression analysis results above can be written as follows:

$$\text{CBR} = 1,539 + 0,498 \text{ education} + 0,003 \text{ midwife} - 0,006 \text{ education} * \text{midwife} + e$$

The probability value of the first test for the moderating variable (midwife) with the dependent variable (CBR) is 0.445. This probability value is below the significance level of 0.1, indicating no significant influence of midwives on CBR. The probability value of the second test for the interaction between education and midwives on CBR is 0.871. This probability value is greater than the significance level of 0.1, indicating no significant influence of the interaction between education and midwife on CBR. The results of the two tests indicate that the moderating variable (midwife) is a Homologiser Moderator. This result means that the midwife variable does not significantly influence the education and CBR variables. Our findings reject hypothesis 4a, which states that there is a significant influence of education and CBR with midwives as

moderators. Midwives function as healthcare professionals who assist pregnant women in the process of prenatal care and childbirth, which is less correlated with the community's education aspect.

**H4b: Healthcare professionals moderate the influence of income on CBR.**

The testing of the role of healthcare workers in moderating the relationship between income and CBR can be concluded by conducting two tests on the probability values of the moderating variable (midwife) and the interaction between the moderating variable and the independent variable (income) on the dependent variable (CBR). The results of these tests are presented in Table 11 and Table 12.

**Table 11.** Test the Influence of Income on CBR

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	3.031	0.484	6.256	0.000
Income	-0.321	0.210	-1.532	0.136
Midwife	-0.009	0.014	-0.632	0.532

The linear equation from the regression analysis results above can be written as follows:

$$CBR = 3,031 - 0,321 \text{ income} - 0,009 \text{ midwife} + e$$

**Table 12.** Test the Interaction Effect of Income and Midwife on CBR

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	4.435	1.228	3.610	0.001
Income	-1.420	0.909	-1.562	0.129
Midwife	-0.058	0.042	-1.382	0.178
Income*Midwife	0.038	0.031	1.241	0.225

The linear equation from the regression analysis results above can be written as follows:

$$CBR = 4,435 - 1,420 \text{ income} - 0,058 \text{ midwife} + 0,038 \text{ income*midwife} + e$$

The probability value of the first test for the moderating variable (midwife) with the dependent variable (CBR) is 0.532. This probability value is below the significance level of 0.1, indicating no significant influence of midwives on CBR. The probability value of the second test for the interaction between income and midwife on CBR is 0.225. This probability value is greater than the significance level of 0.1, indicating no significant influence of the interaction between income and midwife on CBR. The results of the two tests indicate that the moderating variable (midwife) is a Homologiser Moderator. This result means that the midwife variable does not significantly influence the income and CBR variables. Our findings reject hypothesis 4b, which states that there is a significant influence of income and CBR with midwives as a moderator, as the role of midwives is solely as healthcare professionals with a less strong correlation with the community's income aspect.

**CONCLUSION**

The comprehensive analysis conducted in this report sheds light on the demographic landscape and critical factors influencing the crude birth rate (CBR) in Bogor Regency. Drawing from a sample of 259 respondents representing 40 subdistricts, the study revealed intriguing regional patterns and trends. The average age of the participants, standing at 37.06 years, indicates a predominantly adult population engaged in various socioeconomic activities. Notably, the study's male-dominated composition is essential when interpreting the findings. Most respondents are married individuals with educational backgrounds ranging from D2/D2/D3 to Master's degrees, indicating a level of educational attainment within the population. Additionally, the report highlights that despite the majority working 8 hours per day, their income remains below the regional minimum wage, underscoring the economic dynamics prevalent in the region.

Delving into the CBR analysis for Bogor Regency in 2022, the calculated rate of 14.60 reveals a lower figure than the target of 18.65, classifying it as "low" according to standard categorizations. However, the study unveils significant variations in CBR across different districts. Ciampea District records the lowest CBR, while Leuwiliang District has the highest rate.

Furthermore, an intriguing observation surfaces—approximately half of the districts within Bogor Regency exhibit CBR values below the overall CBR of the regency, indicating the presence of localized factors impacting birth rates.

Intriguingly, the report includes regression analysis to explore the relationship between education, income, and CBR. The results unveil a compelling linear equation:  $CBR = 2.026 + 0.402 * Education - 0.390 * Income$ . Confirming the hypotheses, the analysis highlights that education significantly influences CBR, with higher education levels associated with increased birth rates. Conversely, income demonstrates a negative relationship with CBR, signifying that higher income levels tend to correlate with reduced birth rates. Notably, the study also uncovers the moderating influence of healthcare centers *puskesmas* on the relationship between education and CBR, underscoring the importance of accessible healthcare resources in shaping demographic dynamics. The only moderating effect of healthcare services on the relationship between education and CBR is also an interesting finding. The availability of healthcare services can influence the extent to which education affects CBR.

Collectively, the findings derived from this study provide valuable insights into the complex interplay of education, income, and healthcare in influencing the crude birth rate in Bogor Regency. They underscore the significance of educational attainment as a determinant of fertility rates, revealing higher education to be positively associated with increased CBR. Simultaneously, the inverse relationship between income and CBR highlights the impact of economic factors on reproductive decisions. Moreover, the study emphasizes the pivotal role of healthcare centers in shaping demographic patterns, further emphasizing the need for accessible healthcare resources to manage population dynamics effectively. As Bogor Regency continues to evolve, these insights will aid policymakers and stakeholders in formulating targeted strategies to address the evolving demographic landscape and ensure the well-being of its population.

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