# Cesarean section and Socio-Demographic Variables in Algeria: An Analysis Using the 2019 Multiple Indicator Cluster Survey Database(MICS6)

## Chiraz Koussa[1,*], Amar Toaba [2]

[1]Kasdi Merbah University of Ouargla (Algeria)
[2]Laboratory of Population Strategies and Sustainable Development (Algeria)

**Summary:**

Algeria has experienced a concerning increase in cesarean section rates, which points to a shift in childbirth practices that may be driven by non-medical socio-demographic factors. The aim of this study is to identify the socio-demographic variables that lead Algerian women to choose cesarean sections over natural births. To achieve this, a Chi-Square test of independence and Cramér's V statistical test were conducted using the 15-49 Women's File Database from the 2019Multiple Indicator Cluster Survey in Algeria (MICS6).

The statistical analysis showed that cesarean sections in Algeria are linked to several socio-demographic variables, with the most significant being the woman's place of birth, where cesarean deliveries are more common in the private sector compared to natural births. Addressing this challenge requires strategic interventions to ensure that cesarean sections are performed strictly for medical reasons.

**Keywords:** Cesarean section, Socio-demographic variables, Algeria , 2019 Multiple Indicator Cluster Survey (MICS6).

## I- Introduction :
### I.1.Background:

Cesarean section (CS) is a term commonly used in obstetrics to describe the delivery of a viable fetus through an incision in the abdominal wall (laparotomy) and the uterus (hysterotomy)[1], cesarean section is performed when there are some reasons including health mother problems, multiple fetuses, abnormal size or position of the fetus, fetus health problem, and labor is not moving alone[2].

Globally, delivery by cesarean section (CS) ranks among the most common obstetric surgical procedures[3], about 22% of live births in Western countries are by cesarean section and women who undergo cesarean section are 5–20 folds greater than normal vaginal birth women[2]. Cesarean section still cannot replace vaginal delivery in terms of low mortality, neonatal mortality and cost[4]. Efforts have been made to ensure a significant reduction in the maternal mortality rate (MMR) globally, nearly 800 pregnant women die every day from pregnancy- and childbirth-related complications[5].

Over the past three decades, cesarean section have been unnecessarily performed as a surgical intervention (for reasons other than obstetric complications), leading to an increase in C-section rates especially in developing countries[4]. Women who give birth by cesarean face additional unique challenges, with significantly higher risk of postpartum complications[6] and according to The American College of Obstetricians and Gynaecologists and studies from Australia, cesarean births significantly increase a woman's risk of pregnancy-related fatality compared to a woman who delivers vaginally[7].

Unnecessary C-sections not only put expectant and new mothers at risk of developing surgical complications and future reproductive challenges but have also been linked to autism spectrum and hyperactivity disorders in the offspring. In addition to increased risks to maternal and infant health, C-section also contributes to increased healthcare costs, with C-section births costing nearly twice as muchas vaginal births[8]; Worldwide, the approximate cost caused by unnecessary cesareans is estimated to be 2.32 billion dollars[9].

The cesarean section increases the likelihood of requiring a blood transfusion, the risk of anesthesia complications, organ injury, infection, and thromboembolic disease. It has been associated in the long-term with an increased risk of asthma, obesity in children, and complications in subsequent pregnancies, such as uterine rupture, placenta accreta, placenta previa, ectopic pregnancy, infertility, hysterectomy, and intraabdominal adhesions[10].

C-section includes some short and long-term risks, such as reduction in fertility,increased risk of maternal mortality and morbidity, poor obstetric outcomes, requirement of treatment in an intensive care unit (ICU), and need for blood transfusion due to the risky surgical procedure, and women who deliver vaginally are much more likely to have a subsequent vaginal birth[11].

For the woman, a cesarean delivery performed before the development of a lower uterine segment may increase blood loss, the need for blood transfusion, and maternal length of hospitalization[12]. The possible complications during C-section include entrapment of the fetus's head within the pelvis (withdrawing the fetus's head is impossible), rupture of the cervix accompanied by bleeding, damage to the uterus vessels in the low uterus segment incision, bleeding from the placental bed, uterine atony, damage to the bladder, damage to the ureter and bowel, and thromboembolism. Tachypnea, infantile respiratory distress syndrome, hospitalization of the neonate in the intensive care unit (ICU), complications associated with anesthesia, longer hospitalization compared to vaginal delivery, delay in restarting routine activities, later onset of breastfeeding, increased need for re-hospitalization[9].

## I.2.Research question:

Every year, about 18.5 million cesarean sections are conducted around the world[2], this rapid increase in the C-section rate globally is a rising public health concern[13]. Statistics from 159 countries show that between 1990 and 2018, the cesarean section rate increased by 5%. This increase was 12.1% in West Asia[14], and over the past 30 years, the incidence of caesarean section has increased from 5% to about 25% or even more than 50% in some countries[15], and in between 1990 and 2014, C-section rates increased from 6.7% to 19.1% globally, with a 4.2% rise in less-developed countries and a 12.7% rise in more-developed countries[13].

In 2016, Brazil had a percentage of cesarean births of 55.4%, the average global cesarean rate of 18.6% varies between different regions. South America has the highest average cesarean rates in the world (42.9%). The countries with the highest rates of cesarean sections in Latin America and the Caribbean are Brazil (55.6%) and the Dominican Republic (56.4%), Egypt (51.8%) in Africa, Iran and Turkey in Asia (47.9% and 47.5%, respectively), the United States (32.8%) in North America and New Zealand (33.4%) in Oceania[16]; Italy has the highest cesarean section (CS) rate (38.1%) among all European countries[17].

Caesarean sections are one of the most common surgeries performed in the United States, with nearly 1.3 million cesarean sections performed each year, representing nearly one-third of all births[18]; Data from 154 countries, which include about 94.5% of all live births in the world, show that about 21.1% of births are performed by cesarean section. This amount is about 31.7% in west Asia, where Iran is located; In Iran, the cesarean section rate is estimated to be 48%; In many centers, cesarean section because of a previous cesarean section is one of the most common causes of the surgery; About 25.42% of all cesarean sections are performed due to

previous cesarean sections[14] and in Pakistan, proportion of births delivered by Cesarean section has rapidly increased from 3.1% in 1992 to 22.3% in 2017-2018[19]; in Turkey, the rate of cesarean deliveries determined to be 13.9% in 1998, 21.2% in 2003, 36.7% in 2008, 48% in 2013, and 52% in 2018, according to the results of Turkey Demographic and Health Survey[20], and according to the results of the latest population census issued by the Central Agency for Public Mobilization and Statistics, Egypt's average caesarean section in 2021 was 72%, with Egypt ranked third in the world in 2014 at 51.8%, with rates of increase between 2000 and 2021 exceeding 7 times (from 10% to 72%)[21].

As a reference, the World Health Organization, in its 1985 report, suggested an optimal range for C-section rates of 5–15%[4]; Algeria was warned by the organization about the increasing rate of caesarean section deliveries after exceeding this percentage; According to the 2019 Mics-6 multi-indicator cluster survey, caesarean sections made up 24.8% of deliverie, the Ministry of Health, Population and Hospital Reform recorded 490,000 caesarian births out of approximately 1,200,000 births registered annually, equivalent to 45 percent of all deliveries.

The purpose of this study is to determine the socio-demographic factors that lead Algerian women to choose Caesarean sections over natural birth, Which leads us to the following question : What are the most important social and demographic variables that motivate Algerian women to opt for caesarean section instead of natural birth, based on the latest available database of multiple data surveys conducted(MICS6)in Algeria?

To analyze the relationship between sociodemographic variables and cesarean section, we will answer the following sub-questions:
1. Is there an association between a woman's age and having a caesarean section?
2. Is there an association between a woman's educational level and having a caesarean section?
3. Is there an association between a woman's economic activity and having a caesarean section?
4. Is there an association between a woman's wealth index quintile and having a caesarean section?
5. Is there an association between a woman's geographical region in which she lives and having a caesarean section?
6. Is there an association between a woman's place of residence and having a caesarean section?
7. Is there an association between a woman's place of birth and having a caesarean section?

**I.3.Research Hypotheses:**

We propose the following hypotheses to answer the previous sub-questions:
1. There is an association between a woman's age and having a caesarean section.
2. There is a weak association between a woman's educational level and having a caesarean section.
3. There is an association between a woman's economic activity and having a caesarean section.
     There is an association between a woman's wealth index quintile and having a caesarean section.
4. There is a weak association between a woman's geographical region and having a caesarean section.
5. There is a weak association between a woman's place of residence and having a caesarean section.
6. There is an association between a woman's place of birth and having a caesarean section.

**II– Data and Methods:**
**II.1.Data:**

This study is based on database from the Multiple Indicator Cluster Survey in Algeria (MICS6), the Multiple Indicator Cluster Survey (MICS) is an international programme developed by UNICEF to support countries in obtaining data for monitoring key indicators on the situation of women and children.

The Multiple Indicator Cluster Survey (MICS6) was conducted on December 25, 2018, and ended on April 22, 2019 by the Population Directorate of the Ministry of Health, Population and Hospital Reform with a financial contribution from the United Nations Population Fund (UNFPA)and technical and financial support from UNICEF on a sample of 1,253 clusters distributed across all seven regional programming areas (EPT) defined by the National Territorial Development Plan (SNAT). Each cluster includes 25 sample households surveyed, representing a total sample of 31,325 households. The target population groups in the survey consist of sample households and specific individuals such as women aged 15-49 years, children under 5 years, and children aged 5-17 years[22].

The15-49 Women's File Database (WM) was utilized in this study to identify sociodemographic variables linked to caesarean sections.

**II.2.Variables:**

**II.2.1.Dependent variables:**

The dependent variable was caesarean section among women of reproductive age 15-49 who had a live birth in the two years preceding the survey. The variable was coded MN21 and the question was (Accouchement par césarienne), meaning did the birth occur by caesarean section? The answer was yes or no.

**II.2.2.Independent variables:**

Through the database of files of women aged 15-49 years (WM) used in this study, the following independent variables have been identified to study the most important demographic and social factors affecting caesarean section in Algeria :

- Woman's age : coded as WAGE, which includes women from 15 to 49 and is divided into seven categories (15-19), (20-24), (25-29), (30-34), (35-39), (40-44), (45-49).
- Educational level : coded as welevel and includes the following levels : Preschool or None (No formal education), nursery/pre-primary, intermediate, secondary, university (the highest school level).
- Economic activity : coded as woccupation and contains two answers about women's economic activity about whether they are employed or not Employed (not working).
- Wealth index quintile : coded in the database as windex5, and divided into five quintiles (the poorest, second quintile, average, fourth quintile, the richest).
- Geographic region : coded as HH7 and is divided into seven geographical areas covering all of Algeria, (North-Central, North-East, North-West, Central High Plateau, Eastern High Plateau, Western High Plateau, South).
- Place of residence : coded as HH6, includes women from urban or rural areas.
- Place of birth : coded as MN20 and refers in this study to the place where a cesarean section performed.

**II.3.Statistical analysis:**

Statistical analysis is typically employed to examine and analyze data. Therefore, to study the sociodemographic variables related to caesarean section in Algeria, we conducted the Chi-Square test of independence and Cramér's V statistical test ; Using the Statistical Package for the Social Sciences (IBM SPSS Statistics version 26.0).

Chi-square test is used to find if there is any correlation among nonnumeric variables that are frequently used in statistical studies ; And it is symbolized as $\chi^2$ [23]; Cramér's V test is an extension of the chi-squar ($\chi^2$) test and gives an idea of the strength of the relationship between

variables, not just their existence by compare the strength of association between any two cross classification tables. Tables which have a larger value for Cramer's V can be considered to have a strong relationship between the variables, with a smaller value for V indicating a weaker relationship[24].

To ensure the validity of the results and statistical analyses performed, we processed the 2019 Multiple Indicator Cluster Survey database (MICS6) before conducting the statistical test by excluding missing values and excluding women who did not respond to questions related to the studied variables.

## II.4.Ethical Approval:

The study database (MICS6) does not contain any personally identifiable information, and no human subjects were directly involved. Therefore, the study was exempt from requiring ethical approval.

## III- Results and discussion :
## III.1.The first hypothesis :

There is an association between a woman's age and having a caesarean section, to statistically confirm the existence of a relationship between the independent variable, the woman's age, and the dependent variable, caesarean section, we conducted a chi-square ($\chi$2) test based on the following two hypotheses:

H☐: There is no statistically significant relationship between a woman's age and cesarean section.

H☐: There is a statistically significant relationship between a woman's age and cesarean section.

The analysis revealed the following results:

**Table(1): Distribution of cesarean section and women's age: a cross-tabulation**

| Frequency | | Age category | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | |
| Caesarean Section | YES | 14 | 128 | 320 | 372 | 296 | 124 | 15 | 1269 |
| | NO | 48 | 571 | 1193 | 1193 | 881 | 413 | 39 | 4338 |
| Total | | 62 | 699 | 1513 | 1565 | 1177 | 537 | 54 | 5607 |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

Table(1) shows the age distribution of women who underwent a cesarean section and those who underwent a natural birth based on the 2019 Algeria MICS6 survey database, The total number of samples was 5607 women, 1269 of whom underwent a cesarean section and 4338 of whom didn't. The age category 30-34 years recorded the highest number of cesarean sections (372 cases out of 1565 women), and overall, the number of cesarean sections increases among women aged 25–29, 30–34, and 35–39. This suggests that women in this age category may face health risks or complications that make cesarean delivery the safest option in many cases, while the number of cesarean deliveries significantly decreases among younger and older women.

**Table(2):Chi-Square test ($\chi^2$) results for cesarean section and women's age**

| Test | Value | df | Asymptotic Significance(2-sided) |
|---|---|---|---|
| Pearson Chi-square | 15,644[a] | 6 | ,016 |
| Likelihood Ratio | 15,893 | 6 | ,014 |
| Linear-by-Linear Association | 10,515 | 1 | ,001 |
| Number of Valid Observations | 5607 | | |

a. 0 cells (0,0%) have a theoretical count less than 5. The minimum theoretical count is 12,22.

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

Table(2 ) presents the results of the chi-square test ($\chi^2$) for independence between age category and cesarean section, based on the 2019 Multiple Indicator Cluster Survey (MICS6) data. With a p-value of 0,016. Since the p-value is less than 0,05, we can reject the null hypothesis (H□) which states that there is no statistical relationship between women's age and cesarean section, and accept the alternative hypothesis (H□). Therefore, we conclude that there is a statistically significant relationship between women's age category and cesarean section.

After finding a statistically significant relationship between the woman's age and cesarean section using the chi-square test, we can perform Cramer's V test according to the following hypotheses:

H□: There is no strong relationship between the woman's age and cesarean section

H□: There is a strong relationship between the woman's age and cesarean section

**Table(3): Cramér's V results for cesarean section and women's age**

| Test | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | ,053 | ,016 |
| | Cramér's V | ,053 | ,016 |
| Number of valid observations | | 5607 | |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

Table(3) presents the results of the chi-square test ($\chi^2$) using Phi and Cramér's V values to assess the relationship between cesarean section and women's age based on the 2019 Multiple Indicator Cluster Survey (MICS6) data. The analysis revealed a statistically significant relationship between the two variables, as the p-value 0,016 is less than 0,05. Despite this significance, the Phi and Cramér's V values 0,053 are close to 0, suggesting that the relationship between cesarean delivery and women's age is weak, thus we accept the null hypothesis (H□) and reject the alternative hypothesis (H□).

## III.2.The second hypothesis:

There is a weak association between a woman's educational level and having a caesarean section, to statistically confirm the existence of a relationship between the independent variable, the woman's educational level, and the dependent variable, caesarean section, we utilized a chi-square ($\chi^2$) test for the evaluation of the following hypotheses:

H□: There is no statistically significant relationship between a woman's educational level and cesarean section.

H□: There is a statistically significant relationship between a woman's educational level and cesarean section.

The outcomes of the analysis are as follows:

**Table(4): Distribution of cesarean section and women's educational level: a cross-tabulation**

| Frequency | | Women's education level | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | Preschool or None | Nursery/Pre-primary | Intermediate | Secondary | University | |
| Cesarean Section | YES | 122 | 155 | 408 | 308 | 276 | 1269 |
| | NO | 644 | 676 | 1323 | 969 | 725 | 4337 |
| Total | | 766 | 831 | 1731 | 1277 | 1001 | 5606 |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

The previous table (Table 4) shows the distribution of women who underwent or did not undergo cesarean section according to different levels of education, based on the 2019 Algeria MICS6 survey database. In the group of women who received no education or only received pre-school education, we find that the number of women who underwent cesarean section is 122 out of a total of 766 women, while 644 women did not undergo cesarean section. As for the group of

women with primary education, the number of women who underwent cesarean section is 155 out of a total of 831 women, while 676 women underwent natural birth.

Concerning the group of women with intermediate education, Table 4 shows that 408 women underwent cesarean section out of a total of 1731 women, while 1323 women underwent normal delivery.

Regarding the group of women with secondary education, we find that the number of women who underwent cesarean section is 308 out of a total of 1277 women, while 969 women did not undergo cesarean section. Finally, in the group of women with university education, the number of women who underwent cesarean section is 276 out of a total of 1001 women, while 725 women underwent natural birth.

**Table(5):Chi-Square test ($\chi^2$) results for cesarean section and women's educational level**

| Test | Value | df | Asymptotic Significance(2-sided) |
|---|---|---|---|
| Pearson Chi-square | 43,615[a] | 4 | ,000 |
| Likelihood Ratio | 44,946 | 4 | ,000 |
| Linear-by-Linear Association | 40,695 | 1 | ,000 |
| Number of Valid Observations | 5606 | | |

a. 0 cells (0,0%) have an expected count less than 5. The minimum expected count is 173,40.

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

The results of chi-square test ($\chi^2$) showed a value of 43,615 with degrees of freedom equal to 4, and the statistical significance (p-value) was less than 0,05 (0,000). this indicates that there is a statistically significant relationship between women's education level and cesarean section. Since the p-value is less than 0,05, we can reject the null hypothesis (H□) and accept the alternative hypothesis (H□).

As there is a relationship between the woman's educational level and cesarean section, we can detect the strength of the relationship between the two variables using Cramér's test, based on the following hypotheses:

H□: There is no strong relationship between the woman's educational level and cesarean section.
H□: There is a strong relationship between the woman's educational level and cesarean section.
The results of the analysis are as follows:

**Table(6): Cramér's V results for cesarean section and women's educational level**

| Test | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | ,088 | ,000 |
| | Cramér's V | ,088 | ,000 |
| Number of valid observations | | 5606 | |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

The results of Cramér's test for cesarean section and the woman's educational level as shown in the table(6) above, indicated a Phi value of 0,088 with a statistical significance (p-value) equal 0,000 and a Cramér's V value also of 0,088 with a statistical significance (p-value) of 0,000. According to these calculated values, we accept the null hypothesis (H□) and reject the alternative hypothesis (H□), i.e. there is a weak relationship between the woman's educational level and cesarean section.

**III.3.The third hypothesis :**

This hypothesis states that there is an association between a woman's economic activity and having a caesarean section.To test the validity of the relationship statistically between the independent variable (the woman's economic activity) and the dependent variable (cesarean section), a chi-square test ($\chi^2$) was conducted based on the following hypotheses:

H□: There is no statistically significant relationship between a woman's economic activity and cesarean section.

H☐: There is a statistically significant relationship between a woman's economic activity and cesarean section.

**Table(7) : Distribution of cesarean section and women's economic activity : a cross-tabulation**

| Frequency | | Women's Economic Activity | | Total |
|---|---|---|---|---|
| | | Employed | Not Employed | |
| Cesarean Section | YES | 162 | 1107 | 1269 |
| | NO | 391 | 3947 | 4338 |
| Total | | 553 | 5054 | 5607 |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

The table 7 shows the distribution of women who underwent a caesarean section and those who did not (natural delivery) according to their economic activity, based on the 2019 Algeria MICS6 survey database. The total number of women was 5607, of whom 553 were employed and 5054 were not employed; out of 553 employed women, 162 had a caesarean section, while 391 had a natural delivery. Conversely, among 5054 non employed women, 1107 had a caesarean section, while 3947 did not undergo this type of delivery. The following analysis explores whether there is a relationship between cesarean delivery and women's economic activity:

**Table(8):Chi-Square test ($\chi^2$) results for cesarean section and women's economic activity**

| Test | Value | df | Asymptotic Significance (Two-tailed) | Exact Sig. (Two-tailed) | Exact Sig. (One-tailed) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 15,552a | 1 | ,000 | | |
| Continuity Correction b | 15,133 | 1 | ,000 | | |
| Likelihood Ratio | 14,728 | 1 | ,000 | | |
| Fisher's Exact Text | | | | ,000 | ,000 |
| Linear-by-Linear Association | 15,549 | 1 | ,000 | | |
| Number of Valid Observations | 5607 | | | | |

a. 0 cells (0,0%) have an expected count less than 5. The minimum expected count is 125,16.

b. Calculated only for a 2x2 table.

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

The table(8) above shows the results of the Chi-Square ($\chi^2$) test for cesarean section and women's economic activity. The results found statistically significant relationship between cesarean section and women's economic activity at the 0,05 significance level. The low p-values in all tests (Pearson Chi-Square, Continuity Correction, Likelihood Ratio, Fisher's Test) contribute to confirming the existence of this relationship. Therefore, we can reject the null hypothesis (H☐) and accept the alternative hypothesis (H☐).

Based on the results presented, we can perform a Cramér's V test with the following statistical hypotheses:

H☐: There is no strong relationship between the woman's economic activity and cesarean section.

H☐: There is a strong relationship between the woman's economic activity and cesarean section.

The following are the outcomes of the analysis:

**Table(9): Cramér's V results for cesarean section and women's economic activity**

| Test | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | ,053 | ,000 |
| | Cramér's V | ,053 | ,000 |
| Number of valid observations | | 5607 | |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

The table(9) includes the results of Cramér's V test to assess the relationship between cesarean section and the women's economic activity. The table presents the Phi test value, which equals to 0,053 with a statistical significance of 0,000, and the Cramér's V test value, which is also 0,053 with a statistical significance of 0,000. Since the Cramér's V value is low, the relationship between the two variables (cesarean section and women's economic activity)is considered weak. Therefore, we accept the null hypothesis (H□) and reject the alternative hypothesis (H□).

### III.4.The fourth hypothesis :

There is an association between a woman's wealth index quintile and having a caesarean section.To examine the statistical relationship between the independent variable (a woman's wealth index quintile) and the dependent variable (cesarean section), a chi-square test ($\chi^2$) was carried out, following the hypotheses presented below:

H□: There is no statistically significant relationship between a a woman's wealth index quintile and cesarean section.

H□: There is a statistically significant relationship between a woman's wealth index quintile cesarean section.

The results are as follows:

**Table(10): Distribution of cesarean section and woman's wealth index quintile: a cross-tabulation**

| Frequency | | The poorest | Second quintile | Average | Fourth quintile | The richest | Total |
|---|---|---|---|---|---|---|---|
| | | | | Wealth index quintile | | | |
| Cesarean Section | YES | 229 | 278 | 263 | 260 | 239 | 1269 |
| | NO | 1174 | 1012 | 897 | 749 | 506 | 4338 |
| Total | | 1403 | 1290 | 1160 | 1009 | 745 | 5607 |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

The previous table shows the distribution of cesarean sections based on the women's wealth index classified into five categories: the poorest, second quintile, average, fourth quintile, and the richest. The total sample consists 5607 women, 1269 of whom underwent cesarean births and 4338 underwent natural births.

There are no clear differences in the distribution of cesarean sections across the different wealth index categories. A total of 229 women in the poorest category underwent cesarean section, while 278 of them underwent cesarean section in the second category, 263 in the middle category, 260 in the fourth category, and 239 in the richest category. In contrast, the number of women who did not undergo a caesarean section was much higher in all categories, reaching 1174 in the poorest category, 1012 in the second category, 897 in the average category, 749 in the fourth category, and 506 in the richest category. This indicates that the number of women who did not undergo a caesarean section increases among the poor categories compared to the average and the richest categories due to the high financial cost of caesarean sections compared to natural birth.

**Table(11):Chi-Square test ($\chi^2$) results for cesarean section and women's wealth index quintile**

| Test | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 76,415[a] | 4 | ,000 |
| Likelihood Ratio | 75,714 | 4 | ,000 |
| Linear-by-Linear Association | 72,270 | 1 | ,000 |
| Number of Valid Observations | 5607 | | |

a. 0 cells (0,0%) have an expected count less than 5. The minimum expected count is 168,61.

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

The results of the Chi-square test indicate that there is a statistically significant relationship between cesarean section and the level of wealth among women, as the value of the Pearson Chi-square test showed 76,415 at degrees of freedom 4 and statistical significance (.000), meaning that the relationship is not random, and the odds ratio test 75,714 and the linear-linear correlation

72,270 confirm this as well, To assess the association between the wealth index and cesarean birth, we can conduct the Cramér's V test according to the following hypotheses:

H☐: There is no strong relationship between the women's wealth index quintile and cesarean section.

H☐: There is a strong relationship between the women's wealth index quintile and cesarean section.

The results of the analysis are as follows:

**Table(12): Cramér's V results for cesarean section and women's wealth index quintile**

| Test | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | ,117 | ,000 |
| | Cramér's V | ,117 | ,000 |
| Number of valid observations | | 5607 | |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

According to the results of the Cramér's V test, the calculated value was 0,117, which falls within the range of 0,10 - 0,30 indicating a weak relationship between cesarean section and women's wealth index quintile. Given that the relationship is not strong, and therefore we accept the null hypothesis (H☐) and reject the alternative hypothesis (H☐).

### III.5.The fifth hypothesis :

There is a weak association between a woman's geographical region and having a caesarean section. To statistically confirm the existence of a relationship between the independent variable, the woman's age, and the dependent variable, caesarean section, we conducted a chi-square ($\chi$2) test based on the following two hypotheses:

H☐: There is no statistically significant relationship between a woman's geographical region and cesarean section.

H☐: There is a statistically significant relationship between a woman's geographical region and cesarean section.

The analysis revealed the following results:

**Table(13): Distribution of cesarean section and woman's geographical region: a cross-tabulation**

| Frequency | | North-Central | North-East | North-West | Central High Plateau | Eastern High Plateau | Western High Plateau | South | Total |
|---|---|---|---|---|---|---|---|---|---|
| Cesarean Section | YES | 199 | 215 | 174 | 153 | 215 | 147 | 166 | 1269 |
| | NO | 471 | 492 | 510 | 829 | 553 | 656 | 827 | 4338 |
| Total | | 670 | 707 | 684 | 982 | 768 | 803 | 993 | 5607 |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

Table(13) shows the distribution of cesarean sections across different geographical regions. Among the regions, North-East and Eastern High Plateau recorded the highest number of cesarean sections, with 215 cases each, while Western High Plateau recorded the lowest number, with 147 cases. The Central High Plateau region recorded the highest number of natural births, with 829 births, followed by South with 827 natural births. This indicates that some regions have a higher tendency for cesarean births than others.

**Table(14): Chi-Square test ($\chi^2$) results for cesarean section and woman's geographical region**

| Test | Value | Df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 115,550[a] | 6 | ,000 |
| Likelihood Ratio | 116,343 | 6 | ,000 |
| Linear-by-Linear Association | 58,267 | 1 | ,000 |
| Number of Valid Observations | 5607 | | |

a. 0 cells (0,0%) have an expected count less than 5. The minimum expected count is 151,64.

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

Table (14) shows the results of the chi-square test ($\chi^2$) for the relationship between cesarean section and the woman's geographical region, where the Pearson chi-square value is 115,550, with 6 degrees of freedom, and a p-value of 0,000, indicating the existence of a statistically significant association between cesarean section and geographical region at a significance level of 0,05. The likelihood ratio test also supports this result, with a value of 116,343 and a p-value of 0,000. Therefore, we accept the alternative hypothesis (H□) and reject the null hypothesis.

To assess the relationship between a woman's geographical region and cesarean section, we perform the Cramér's V test as follows:

H□: There is no strong relationship between the  woman's geographical region and cesarean section.

H□: There is a strong relationship between the woman's geographical regionand cesarean section.

The results of the analysis are as follows:

**Table(15): Cramér's V results for cesarean section and woman's geographical region**

| Test | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | ,144 | ,000 |
| | Cramér's V | ,144 | ,000 |
| Number of valid observations | | 5607 | |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

Table (15) presents the results of Cramer's V test to study the relationship between cesarean section and the woman's geographical region. The value of Cramer's V reached 0,144, with a statistical significance value (p-value) of 0,000, meaning that there is a weak relationship with statistical significance between cesarean section and the geographical region at a significance level of 0,05. Accordingly, we accept the hypothesis that states there is a weak association between a woman's geographical region and having a caesarean section.

### III.6.The third hypothesis :

There is a weak association between a woman's place of residence and having a caesarean section. To statistically confirm the existence of a relationship between the independent variable, the woman's place of residence, and the dependent variable, caesarean section, we utilized a chi-square ($\chi^2$) test for the evaluation of the following hypotheses:

H□: There is no statistically significant relationship between a woman's place of residence and cesarean section.

H□: There is a statistically significant relationship between a woman's place of residence and cesarean section.

The outcomes of the analysis are as follows:

**Table(16): Distribution of cesarean section and woman's place of residence: a cross-tabulation**

| Frequency | | Place of Residence | | Total |
|---|---|---|---|---|
| | | Urbain | Rural | |
| Cesarean Section | YES | 834 | 435 | 1269 |
| | NO | 2627 | 1711 | 4338 |
| Total | | 3461 | 2146 | 5607 |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

**Table (17): Chi-Square test (χ²) results for cesarean section and a woman's place of residence**

| Test | Value | df | Asymptotic Significance (2-sided) | Exact Significance (2-sided) | Exact Significance(1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 11,079[a] | 1 | ,001 | | |
| Continuity Correction [b] | 10,861 | 1 | ,001 | | |
| Likelihood Ratio | 11,195 | 1 | ,001 | | |
| Fisher's Exact Test | | | | ,001 | ,000 |
| Linear-by-Linear Association | 11,077 | 1 | ,001 | | |
| Number of Valid Observations | 5607 | | | | |

a. 0 cells (0,0%) have an expected count less than 5. The minimum expected count is 485,69.

b. Calculated only for a 2x2 table.

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

The table (16) shows the distribution of caesarean sections based on the woman's place of residence. It is evident that urban areas witness a higher number of caesarean sections, reaching 834 caesarean sections, in urban areas compared to 435 in rural areas, indicating that caesarean sections are more common in urban areas.

The results of the chi-square test indicating a statistically significant relationship between the woman's place of residence and caesarean section, the value of the Pearson chi-square test reached 11,079 with one degree of freedom and p-value of 0,001, which explains association between the two variables. Both Fisher's Exact Test and the Linear-by-Linear Association further support the association of this relationship.

As there is a relationship between the woman's place of residence and cesarean section, we can detect the strength of the relationship between the two variables using Cramér's test, based on the following hypotheses:

H□: There is no strong relationship between the woman's place of residence and cesarean section.

H□: There is a strong relationship between the woman's place of residence and cesarean section.
The results of the analysis are as follows:

**Table(18): Cramér's V results for cesarean section and woman's place of residence**

| Test | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | ,044 | ,001 |
| | Cramer's V | ,044 | ,001 |
| Number of Valid Observations | | 5607 | |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

The table(18) above presents the results of Cramér's V test to assess the strength of the relationship between cesarean section and the woman's place of residence. The calculated value indicates a weak relationship between the two variables. This result is supported by the Phi test with the same value and significance, demonstrating consistency in the results.

**4.7 The seventh hypothesis :** There is an association between a woman's place of birth and having a caesarean section, we aim to explore whether there is a significant relationship between the woman's place of birth and cesarean section using the Chi-Square test, according to the following hypotheses :

H□: There is no statistically significant relationship between a woman's place of birth and cesarean section.

H□: There is a statistically significant relationship between a woman's place of birth and cesarean section.

The analysis revealed the following results:

Table(19) shows the distribution of cesarean sections by the woman's place of birth. Out of 1269 women who underwent non-vaginal delivery, hospitals (EHS/EH/EPH) recorded the highest number of cesarean sections, totaling 781 cases, followed by private clinics, which registered 293 cesarean deliveries. The University Hospital Center reported a smaller number, with 120 cesarean deliveries.

In contrast, a very limited number of cesarean sections were recorded in other places such as polyclinics/Maternity Hospitals, Maternity Care Units and Private maternity hospitals.

From the table above, it is evident that cesarean deliveries are more inclined towards the private sector compared to natural deliveries, as Private clinics recorded 147 vaginal deliveries out of 4338 women who gave birth naturally, which is a much lower number compared to cesarean deliveries in the same category. Similarly, private maternity hospitals, they recorded only 18 natural births, while other private medical facilities recorded 5 natural births.

Moving on to Table(20), which shows the results of the Chi-square ($\chi^2$) test for cesarean section and a woman's place of birth, where the Pearson chi-square value reached 673,563 with 9 degrees of freedom, and the probability value (p-value) was 0,000, indicating the existence of a statistically significant relationship between cesarean section rates and place of birth. Meaning, the distribution of cesarean births differs clearly according to place of birth, and accordingly we accept the alternative hypothesis (H□) and reject the null hypothesis (H□) that denies the statistical relationship between cesarean section and place of birth.

**Table(19): Distribution of cesarean section and woman's place of birth: a cross-tabulation**

| Frequency | | Your residence | University Hospital Center | Hospital (EHS/EH/EPH) | Polyclinic/ Maternity Hospital | Maternity Care Unit | Other public sector | Private clinic | Private maternity hospital | Other private medical facility | Other (please specify) | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Caesarean Section | YES | 0 | 120 | 781 | 45 | 4 | 2 | 293 | 20 | 4 | 0 | 1269 |
| | NO | 2 | 223 | 3288 | 640 | 14 | 0 | 147 | 18 | 5 | 1 | 4338 |
| Total | | 2 | 343 | 4069 | 685 | 18 | 2 | 440 | 38 | 9 | 1 | 5607 |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

**Table(20): Chi-Square Test ($\chi^2$) results for cesarean section and woman's place of birth**

| Test | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 673,563[a] | 9 | ,000 |
| Likelihood Ratio | 596,831 | 9 | ,000 |
| Linear-by-Linear Association | 423,041 | 1 | ,000 |
| Number of Valid Observations | 5607 | | |

a. 8 cells (40,0%) have a theoretical count less than 5. The minimum theoretical count is 0,23.

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

To assess the association between the woman's place of birth and cesarean birth, we can conduct the Cramér's V test according to the following hypotheses:

H□: There is no strong relationship between the women's place of birth and cesarean section.

H□: There is a strong relationship between the women's place of birth and cesarean section.

The results of the analysis are as follows:

**Table(21): Cramér's V results for cesarean section and woman's place of birth**

|  |  | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | ,347 | ,000 |
|  | Cramér's V | ,347 | ,000 |
| Number of Valid Observations |  | 5607 |  |

The source: prepared by the researchers based on the 2019 Multiple Indicator Cluster Survey Database (MICS6)

Table(21)presents the results of the Cramér's V test between the independent variable, the woman's place of birth, and the dependent variable, the caesarean section. The value of both the Cramér's V and Phi tests reached 0,347, which indicating a moderate-strength relationship between the two variables with a statistical significance of 0,000. Since the probability value is less than 0,05, the relationship is statistically significant. Therefore, the alternative hypothesis(H□), which states that there is a strong relationship between the woman's place of birth and cesarean section, is accepted, while the null hypothesis(H□), which posits no strong relationship, is rejected.

## IV- Conclusion:

By studying the most important sociodemographic variables of cesarean section in Algeria by analyzing a Multiple Indicator Cluster Survey Database (MICS6) 2019, we reached the following:

- From a total study sample of 5607 women, 1269 of whom underwent a cesarean section and 4338 of whom underwent a natural birth. The age category 30-34 years recorded the highest number of cesarean sections (372 cases out of 1565 women). In general, the number of cesarean sections increases among women aged 25-29, 30-34, and 35-39, indicating that women in this age category may face health risks or complications that make cesarean section the safest option in many cases, while the number of cesarean sections decreases significantly among younger and older women.

- Cesarean sections are higher among educated women, as the highest percentage of cesarean sections was among women with intermediate 408 and secondary education 308, followed by women with university education, this is likely due to health awareness or cultural and social influences.

- Among employed women, there were 162 caesarean births, while 391 were natural births. As for non-employed women, there were 1107 caesarean births compared to 3947 natural births. The overall figure indicates that the vast majority of non-employed women have a caesarean section. This reflects that non- employed women may face circumstances that increase the likelihood of a caesarean section, such as limited access to quality health care during pregnancy.

- There were no clear differences in the distribution of caesarean section cases across the different wealth index categories. The number of women who had a vaginal birth was significantly higher in all categories. This suggests that the number of women who did not have a caesarean section is higher among the poorer categories than the middle and richer categories due to the higher financial cost of caesarean sections compared to vaginal birth.

- The North-East and Eastern High Plateau recorded the highest number of caesarean sections, with 215 cases each, while the Western High Plateau recorded the lowest number, with 147 cases. The Central High Plateau region recorded the highest number of natural births, with 829 births, followed by the South with 827 natural births. This indicates that some regions have a higher tendency for caesarean births than others.

- Urban areas had a higher number of cesarean deliveries, with 834 cesarean deliveries in urban areas compared to 435 cesarean deliveries in rural areas, indicating that cesarean deliveries are more common in urban areas. This can be explained by the availability of advanced healthcare in cities, compared to the difficulties that women in rural areas may face

in accessing cesarean delivery services. In conclusion, There is a weak statistical relationship between cesarean delivery and woman's age, woman's educational level, woman's economic activity, woman's wealth index quintile, woman's geographical region, woman's place of residence.

- It is clear that cesarean deliveries are more skewed towards the private sector compared to natural deliveries, as private clinics recorded 147 vaginal deliveries out of 4,338 women who gave birth naturally, which is a much lower number compared to cesarean deliveries in the same category. Out of 1,269 women who underwent non-vaginal delivery, hospitals (EHS/EH/EPH) recorded the highest number of cesarean sections, totaling 781 cases, followed by private clinics, which registered 293 cesarean deliveries. The University Hospital Center reported a smaller number, with 120 cesarean deliveries. There is a strong relationship between cesarean delivery and woman's place of birth.

we believe this is due to several factors; Firstly, the woman's personal preferences to avoid the pain of natural birth and her fear of complications during birth or her belief that cesarean delivery is a safer option. In addition, some doctors may prefer to perform cesarean sections to save time and effort, as natural birth takes longer than cesarean; Moreover, cesarean deliveries are more profitable for private hospitals due to the high costs of care and longer stay.

The increase in cesarean births in Algeria and its association with the private sector in particular represents a public health problem. Accordingly, one of the priorities of national public policies should be to reduce elective cesarean births by promoting a culture of natural birth and highlighting the potential risks of cesarean birth, which may help women make informed decisions about the method of delivery, in addition to developing unified medical guidelines and practices for all private hospitals and clinics directing doctors to perform cesarean sections only when there is a medical necessity, and tightening control over wages and incentives to ensure that doctors are not financially motivated to perform unnecessary cesarean sections.

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