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# Is Primary Cesarean Section a Cause of Increasing Cesarean Section Rates in Greece?

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**ABSTRACT**

**Introduction:** Cesarean Section is a surgical procedure which can be life saving and necessary in some circumstances. Nonetheless, Cesarean Delivery continues to result in increased complications for subsequent deliveries as well as increased financial costs. This phenomenon raises concerns over the growing rates of Cesarean deliveries among women at low risk for a complicated birth whose first delivery was by Cesarean Section for non-medical reasons. **Aim:** The aim of this study was to determine whether PCS is a main factor in the overall percentage of CS in Greece and define the causes of elective and emergency cesarean sections in primary ones. **Methods:** From 365 cesarean deliveries during the research period, a sample of 162 women who underwent a primary cesarean section at a Greek University hospital has consented to participate. Medical and demographic data as well as data from women's medical dossier were used in the day 3 postpartum. **Results:** Out of 162 primiparous mothers, 38.9% underwent an emergency cesarean section and 61.1% an elective cesarean section. Furthermore, the results show that women, who had been diagnosed with stress disorders or depression, with abnormal fetal heart rate, pathological NST/Doppler and had developed complications after cesarean section, were more likely to undergo an emergency cesarean delivery. **Conclusion**: This survey shows the lack of evidence-based guidelines in obstetrician's practice and the lack of perinatal support centers in Greece. Primary CS can be characterized as a key factor in the overall increase of CS, given the vicious cycle of recurrence of a Cesarean delivery.

**Key words:** Cesarean Section, primary Cesarean Section, risk factors for primary cesarean section, cesarean section rates.

## 1. INTRODUCTION

Although there is no evidence that Cesarean Section (CS) reduces maternal/infant perinatal morbidity or mortality, the rates have been increasing both in high and low-income countries. On the other hand, CS is associated with short- and long-term risks that may persist for many years thereafter, affecting the health of both the mother and child (1-3). Anesthetic complications, increased rates of blood transfusion due to hemorrhage, pelvic organ damage, thromboembolic events and infections (surgical site infection involving superficial wound infection, endometritis, etc.) are included among the maternal short-term complications of CS. It is a classic knowledge that the mean blood loss at cesarean delivery is approximately 1000 mL. However, blood loss >1500 mL occurs in <20% of primary cesarean deliveries increasing, at least, the morbidity rates. Although routine administration of oxytocin after the newborn is delivered is an almost universal strategy reducing postpartum blood loss, high morbidity and mortality rates due to postpartum hemorrhage are stable findings in underdeveloped countries. Furthermore, the oxytocin itself could increase morbidity rates in certain instances as in rapid administration resulting in hypotension or other complications (4). Adding to the complexity, in contrast to vaginal delivery, the optimal dose and route of administration (ie, bolus dose versus infusion) of oxytocin at cesarean delivery are unclear. The risk of severe maternal morbidity is generally higher in women with an emergency cesarean delivery than in those with a planned cesarean section. Similarly, cesarean section decided in the second stage of labor is generally

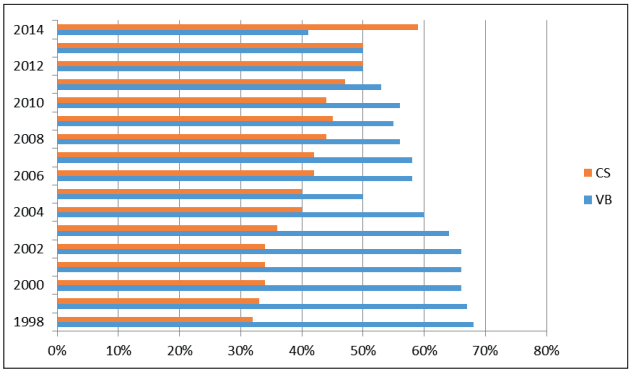


Figure 1. The evolution proportions of CSs-Vaginal Births (VG). Data from the Hellenic Statistical Authority (ELSTAT)

associated with higher maternal morbidity than CS decided in the first stage of labor (5). The increased probability of respiratory distress is the main short-term complication for the neonates. Placenta accreta and uterine rupture are included among the long-term maternal complications of CS in subsequent pregnancies. Finally, obesity and asthma are included among the long-term complications of children born by CS. Thus, CS should be performed only when necessary. Despite these risks, CS rates have increased worldwide over the past few decades all over the world (1). South America, with CS exceeding 42.9%[6], has the highest rates of CS worldwide, with rates in Brazil exceeding 55.8% (1).In Europe, Cyprus, Romania, Bulgaria, Poland and Italy are included in the countries with the highest rates of planned C-sections (7). Primary Cesarean Section (PCS) can be considered a key driver of the overall CS rates, since there is a risk of repetition in the next pregnancy (8). As with most surgical procedures, a CS can save the life of the mother or infant, however sometimes exposing them to immediate or long-term risks (9-12). Some of the main maternal complications include postpartum infection, death, bladder injury, abnormal placenta position, preterm birth, ectopic pregnancy and others (2, 9, 13). Furthermore, there is evidence that CS may also affect the hormonal and microbiological physiology of the infant potentially increasing the risk of allergies with negative effect on the development of a child's immune system which is thought to be responsible for childhood asthma (8).

The percentage of CS in Greece is almost double to the European average. According to the World Health Organization (WHO), CSs far out-number natural births, with the former reaching over 50% of the total (14), given that in the past private maternity wards often declined to give specific data for the procedure, citing "commercial privacy". The WHO suggested that only 15% of birth should be performed by CS, a percentage much lower than the 58.8% (Figure 1) of our country (15) and almost double of the European average, ranking Greece in the first place in Europe in CS (14). Greece is one of the 5 countries (Iceland, Montenegro, Portugal and Slovakia) that do not provide official data to the WHO and other international organizations on CS rates (16). However, the increase in CS rates from 1998 to 2014 without clear evidence of corresponding decreases in maternal or infant morbidity or mortality (17) shows overuse of CS.

In order to understand how a CS may be prevented, it is necessary to know why it is performed. The most common factors linked to PCS included high maternal age (18), obesity (19), failure of labor to progress, dystocia (20, 21), abnormal infant heart rate, fetal malpresentation, fetal macrosomia and multiple gestation (22) but, it is difficult to identify the morbidity caused specifically by vaginal delivery. For example, in certain clinical conditions such as placenta previa, CS was established as the safest type of delivery. However, for low-risk pregnancies, CS appears as a greater risk of maternal morbidity and mortality than vaginal delivery (23). The high percentage of women who undergo a PCS in Greece shows the easy decision of obstetricians to perform a CS, as well as the lack of evidence-based guidelines (24-26). Therefore, women who undergo unnecessary CS are exposed to unreasonable risks.

Unfortunately, in Greece the Trial of Labor after Cesarean Delivery (TOLAC) is not applied in practice, although it could achieve a percentage of 60%-72.8% of vaginal deliveries in women with previous CSs (27, 28). TOLAC is a scheduled trial for vaginal delivery for a woman who has previously undergone CS. This method enables the opportunity to achieve a vaginal birth after cesarean (VBAC), gives an opportunity to women with a history of Cesarean deliveries to have a normal birth and thus to stop the vicious cycle of CSs (29). Another long-standing component in Greece is the fact the CS costs more than a vaginal delivery. Both medical practitioners and private maternity hospitals usually bill higher costs, something that the public health care funds and private insurance providers alike have accepted over the years (30). Furthermore, a majority of women who use public maternity services in Greece face an under-the-table payment system, corresponding approximately to the net salary of an intern physician (31).

## 2. AIM

The aim of this study was to determine whether PCS is a main factor in the overall percentage of CS in Greece and define the causes of elective and emergency Cesarean Sections in primary ones.

## 3. PATIENTS AND METHODS

This cross-sectional study took place from August 2019 to February 2020 at the maternity unit of the University Hospital of Larisa in Greece. From 365 CS deliveries during the research period, 162 women underwent PCS (Figure 2).

The data were collected from the women's medical records and from a researcher's questionnaire following an interview on the 3rd postpartum day (with the written consent of the women). More specifically, the medical, gynecological, mental history and the pathology of gestation was recorded, as well as, the type of conception, and the causes that led to an emergency cesarean section (EMCS) or elective cesarean section (ELCS).

Survey participants were all the women who gave birth with EMCS or ELCS and gave their written consent for their participation. This prospective study took place from July to November 2019, at the obstetrics clinic of the General University Hospital of Larissa in Greece. It was approved by the University Hospital of Larisa Ethics Commission. Approval: 18838/08-05-2019.

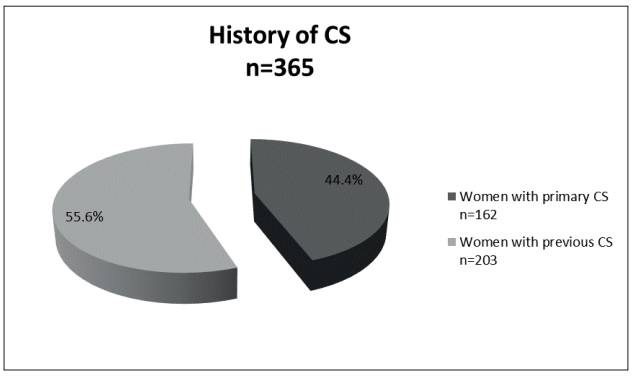


Figure 2. History of CS

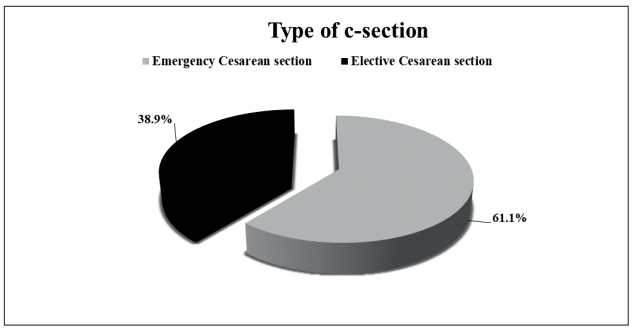


Figure 3. Type of PCS

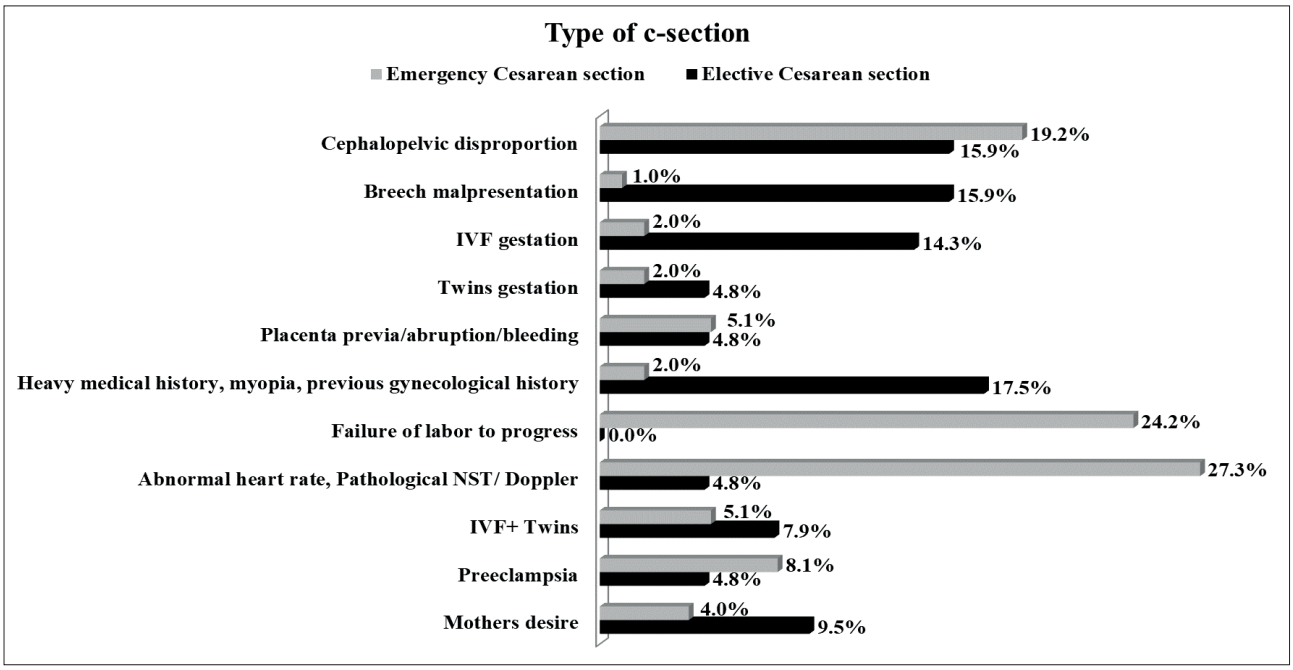


Figure 4. Proportion of causes of CS according to the type of (CS)

### Statistical analysis

The chi-square or Fisher's exact test were used to analyze qualitative variables. Logistic regression analyses with backward stepwise selection were performed to assess factors associated with the type of c-section. The results of the logistic regression analyses have been presented by unadjusted and adjusted odds ratios with 95% confidence intervals. All statistic tests were two-tailed, with a significant set at $p < 0.05$. All statistical analyses were performed using SPSS v.25.0 (SPSS; Chicago, IL, USA).

## 4. RESULTS

### 4.1. Demographic characteristics of the participants

Table 1 shows the percentage distribution of women by their socio-demographic characteristics. Of the 162 women participating in the study, 99 (61.1%) had an EMCS and 63 (38.9%) an ELCS (Figure 3). Eighty-six-point four percent of the respondents live in the city while 13.6% live in villages. The mean age (SD) was 32.5 (6.0) years. Although there was no statistically significant age difference between women who underwent an emergency CS and an elective one, a greater mean age of almost two years was found in the latter group. This finding confirms the anecdotal observation that older women in Greece have a greater probability for ELCS. The vast majority (92.6%) was married, and almost half of the participants (42.6%) had a secondary level of education. Thirty-five-point two percent of the respondents were employed in the public/private sector with a middle financial status (78.4%). One hundred fifty-two (93.8%) of the cases were Orthodox Christians and 148 (91.4%) were Greeks. The distribution of socio-demographic characteristics was comparable between the delivery groups. However, women who live in the city were more likely to undergo an EMCS (p=0.037).

### 4.2. Causes of emergency and elective cesarean section

Figure 4 shows the rates of EMCS and ELCS as per the causes that provoked a CS. As the graph shows, a large percentage of women (27.3%) underwent EMCS because of fetus abnormal heart rate, compared to women who were forced to have an ELCS with the same symptoms (4.8%). Furthermore, 24.2% of the sample underwent EMCS due to failure of labor to progress, while 19.2% of women underwent EMCS due to cephalopelvic disproportion and 15.9% underwent an ELCS due to breech malpresentation. In addition, the mother's desire for CS is presented as a total percentage of 13.5%.

| | Total (n=162) | | Emergency Cesarean Section (n=99) | | Elective Cesarean Section (n=63) | | |
|---|---|---|---|---|---|---|---|
| Variables | N | % | N | % | N | % | p-value‡ |
| Address | | | | | | | 0.037 |
| City | 140 | 86.4 | 90 | 90.9 | 50 | 79.4 | |
| Village | 22 | 13.6 | 9 | 9.1 | 13 | 20.6 | |
| Age | | | | | | | 0.064 |
| Mean (SD) | 32.5 (6.0) | | 31.8 (6.1) | | 33.6 (5.8) | | |
| Min–Max | 18-48 | | 18-48 | | 19-44 | | |
| Family status | | | | | | | 0.412 |
| Married | 150 | 92.6 | 93 | 93.9 | 57 | 90.5 | |
| Unmarried | 12 | 7.4 | 6 | 6.1 | 6 | 9.5 | |
| Educational level | | | | | | | 0.708 |
| Primary school | 7 | 4.3 | 5 | 5.1 | 2 | 3.2 | |
| Junior high school | 9 | 5.6 | 7 | 7.1 | 2 | 3.2 | |
| Senior High school | 69 | 42.6 | 40 | 40.4 | 29 | 46 | |
| University | 63 | 38.9 | 37 | 37.4 | 26 | 41.3 | |
| Msc/ PhD | 14 | 8.6 | 10 | 10.1 | 4 | 6.3 | |
| Occupation | | | | | | | 0.240 |
| Public/private sector | 57 | 35.2 | 33 | 33.3 | 24 | 38.1 | |
| Freelance | 31 | 19.1 | 19 | 19.2 | 12 | 19 | |
| Health care professional | 11 | 6.8 | 4 | 4 | 7 | 11.1 | |
| Educators | 14 | 8.6 | 12 | 12.1 | 2 | 3.2 | |
| Household | 30 | 18.5 | 19 | 19.2 | 11 | 17.5 | |
| Unemployed | 19 | 11.7 | 12 | 12.1 | 7 | 11.1 | |
| Financial status | | | | | | | 0.634 |
| Low | 31 | 19.1 | 21 | 21.2 | 10 | 15.9 | |
| Middle | 127 | 78.4 | 76 | 76.8 | 51 | 81 | |
| High | 4 | 2.5 | 2 | 2 | 2 | 3.2 | |
| Religion | | | | | | | 0.206 |
| Orthodox Christians | 152 | 93.8 | 91 | 91.9 | 61 | 96.8 | |
| Other | 10 | 6.2 | 8 | 8.1 | 2 | 3.2 | |
| Nationality | | | | | | | 0.407 |
| Greek | 148 | 91.4 | 89 | 89.9 | 59 | 93.7 | |
| Other | 14 | 8.6 | 10 | 10.1 | 4 | 6.3 | |
| Minority | | | | | | | 1.000 |
| No | 157 | 96.9 | 96 | 97 | 61 | 96.8 | |
| Yes | 5 | 3.1 | 3 | 3 | 2 | 3.2 | |

Table 1. Distribution of participants' characteristics for women with EMCS and ELCS ǂ Chi-square or Fisher exact tests were used for qualitative variables and independent samples t-test was used for continuous variables

**4.3. Factors associated with the type of CS**

Univariate logistic regression analyses were conducted for all known/expected prognostic factors. Furthermore, a multivariate logistic regression model was conducted, with backward model selection procedure, in order to define possible factors which were associated with the type of CS. In addition, the multivariate logistic regression model included age as a known confounding factor.

According to the univariate logistic regression analyses, the factors that associated with the type of CS were address (OR=2.60, p=0.041), causes of CS (OR=13.50, p=0.003) and complications after CS (OR=10.21, p=0.027). The multivariate analysis indicated that women had been diagnosed with stress disorders (OR=19.32, p=0.035) or depression (OR=25.27, p=0.041), with abnormal heart rate, pathological NST/ Doppler (OR=27.33, p=0.005) and had developed complications after CS (OR=69.14, p=0.001) were more likely to undergo an emergency cesarean delivery (Table 2). More specifically, stress disorder or depression, abnormal heart rate, pathological NST/ Doppler and postpartum complications were statistically significant factors related to the type of CS.

## 5. DISCUSSION

The aim of this study was to determine whether PCS is a main factor in the overall percentage of CS in Greece. Despite the worldwide interest in this topic, this is the first research to have used data from a group of PCS women to identify and explore factors associated with EMCS or ELCS. The data from a large university hospital in Greece revealed an increasing rate of CS deliveries driven by increases in both EMCS and ELCS. In this research we observed that women with psychiatric history, more specifically with anxiety disorders and depression, were more likely to undergo an EMCS (32). These results show that women with these mental health disorders were often unable to respond to the normal course of delivery. It seems that the lack of diagnosis of the above disorders sin prenatal period and the lack of physical preparation for childbirth affect the increase of stress and the reduced cooperation or the exhibition of tokophobia during delivery in those women. In Greece there are a few perinatal supporting centers that help women (in antenatal and postnatal periods) with current or past mental problems. The Non-Profit/ Non-Governmental Organization (NGO) "Fainareti" is the only public funded service in Greece that manages mental health problems of women in the perinatal period (33). Contrary to Greece, in Northern European countries with low CS rates, the majority of

| | Unadjusted OR (95% CI) | p-value | Adjusted OR (95% CI) | p-value |
|---|---|---|---|---|
| Psychiatric history | | | | |
| Stress disorders | 7.06(0.88-56.62) | 0.066 | 19.32(1.23-304.81) | 0.035 |
| Depression | 1.41(0.13-15.93) | 0.780 | 25.27(1.14-560.26) | 0.041 |
| Psychotic syndromes | 1.41(0.13-15.93) | 0.780 | 1.91(0-788.81) | 0.833 |
| No | 1 | | 1 | |
| Atomic health history | | | | |
| Low-risk | 0.62(0.25-1.52) | 0.298 | | |
| High-risk | 0.65(0.22-1.91) | 0.435 | | |
| No | 1 | | | |
| Gynecologic history | | | | |
| Intrauterine fetal demise/miscarriages/ recurrent miscarriages/ ectopic pregnancy | 0.74(0.26-2.10) | 0.567 | | |
| Surgeries | 0.57(0.04-9.36) | 0.696 | | |
| Uterine & Ovarian pathology | ǂ | | | |
| Birth of a dead infant | ǂ | | | |
| No | 1 | | | |
| Pathology of gestation | | | | |
| Oligohydramnios/ polyhydramnios | 0.80(0.05-13.10) | 0.873 | | |
| Preeclampsia/Increased impedance to flow in the uterine arteries, thrombophilia, HELLP syndrome, hyperemesis | 2.71(0.92-7.93) | 0.069 | | |
| Placenta previa (type 4)/ abruption/ bleeding | 0.48(0.11-2.11) | 0.330 | | |
| Diabetes | 2.19(0.65-7.36) | 0.205 | | |
| Cervical insufficiency | 3.98(0.45-35.37) | 0.215 | | |
| Premature contractions & Infection | 1.19(0.19-7.47) | 0.849 | | |
| Uteroplacental/ vascular/ insufficiency, single umbilical artery | 1.99(0.37-10.77) | 0.424 | | |
| No | 1 | | | |
| Gestational weeks | 0.98(0.86-1.11) | 0.740 | | |
| of labor | | | | |
| 22- 27,6 (extreme preterm) | ǂ | | | |
| 32-36+6(late preterm) | 0.85(0.35-2.08) | 0.723 | | |
| 37- 40+2 | 1 | | | |
| Causes of c-section | | | | |
| Cephalopelvic disproportion | 2.85(0.65-12.51) | 0.165 | 4.42(0.54-36.39) | 0.167 |
| Breech malpresentation | 0.15(0.01-1.68) | 0.123 | 0.17(0.01-4.79) | 0.298 |
| IVF gestation | 0.33(0.05-2.43) | 0.279 | 0.14(0.01-2.80) | 0.200 |
| Twins gestation | 1.00(0.11-8.95) | 1.000 | 1.02(0.05-19.32) | 0.991 |
| Placenta previa/abruption/bleeding | 2.50(0.37-16.89) | 0.347 | 1.36(0.09-21.75) | 0.827 |
| Heavy medical history, myopia, previous gynecological history | 0.27(0.04-1.95) | 0.196 | 0.44(0.03-5.78) | 0.528 |
| Failure of labor to progress | ǂ | | ǂ | 0.998 |
| Abnormal heart rate, Pathological NST/ Doppler | 13.50(2.37-76.82) | 0.003 | 27.33(2.77-270.09) | 0.005 |
| IVF+ Twins | 1.50(0.26-8.82) | 0.654 | 1.18(0.1-14.11) | 0.898 |
| Preeclampsia | 4.00(0.64-25.02) | 0.138 | 2.38(0.19-30.02) | 0.503 |
| Mothers desire | 1 | | 1 | |
| Complications after c-section | | | | |
| (bleeding, preeclampsia, infection, early postpartum mental disorders) | 10.21(1.31-79.72) | 0.027 | 69.14(5.55-861.08) | 0.001 |
| No | 1 | | 1 | |

Table 2. Results of logistic regression model for the factors associated with the type of CS. ǂ could not be computed due to no distribution OR=Odds Ratio, CI=Confidence Interval, p<0.05

women attend maternal mental health services during the perinatal period (34-36). Antenatal counseling by midwives with appropriate approaches should be strengthened to protect women from pregnancy mental health problems (37). Regarding the causes of CS, the fetus abnormal heart rate and Pathological NST/ Doppler, appear to be an important factor associated with EMCS. In (Table 2) we see that the deliveries took place up to 40+2 weeks of gestation including spontaneous onset of labor and inductions. The World Health Organization (WHO) and other evidence-based guidelines around the world, suggest induction of labor between 41-42 weeks (38-41). Therefore, gestational age less than 41 weeks is considered as an uncomplicated pregnancy (38) and the induction of labor may result in CS delivery (42). The results of this study also show that EMCS is associated with more complications in early postpartum period such as bleeding, preeclampsia, infection, and early postpartum mental disorders. It is already known that an urgent surgery is an unexpected and more unpleasant birth experience than the ELCS and is also associated with more mental health problems during pregnancy (43), as well as postoperative complications (44). To prevent CS complications on the physical and mental health of the mother, antenatal and intrapartum guidelines (24, 25) and non-clinical interventions (26) are recommended.

## 6. CONCLUSION

The sample of this study consisted of a large percentage of primiparous women who underwent a CS (EMCS-ELCS). The effort to investigate the causes was made due to the high percentage of CS in Greece, which are much higher than those defined by the WHO. The results therefore showed that the causes that led the primiparous to a CS do not meet the WHO recommendations, for example, the high rates of ELCS due to breech presentation and twins' gestation. In addition, the psychiatric history as a cause of EMCS and the high rates of mother desire shows the lack of perinatal care centers in Greece. Despite the WHO recommendations to decrease CS rates in Greece, the problem is exacerbated with negative consequences for the health of both women and children, extending in the national economy. In order to solve the Gordian Knot puzzle for CS, health policies and the promotion of vaginal delivery must be implemented. Furthermore, financial strategies including reforms which will give higher compensation for vaginal births and less for CSs must also be established. In addition, maternity care provided by a friendly health care based on midwifery practices, rather than a medical-orientated health care, is considered necessary to decrease CS rates. For this purpose, the number of midwives must increase in relation to the large number of obstetricians. Finally, there is great need for psychoeducation services for mothers before and during pregnancy and especially programs for women with mental disorders or tokophobia led by midwives. As it was found, PCS is a major factor of increasing CS rates in Greece, including the lack of evidence-based guidelines and the absence of health care strategies and policies.

- **Patient Consent Form:** All participants were informed about subject of the study.
- **Author's contribution:** (E.A): conceptualization, supervision, validation, visualization, writing, data analyzing, original draft and editing, (E.O): visualization, project administration, methodology, data analyzing, (A.S): methodology and editing, supervision, validation, (M.I): methodology, validation, (E.P): validation, methodology, (A.S): methodology, validation, (G.I): methodology, validation, supervision, (M.D): review and editing, supervision, validation. All authors have read and approved the manuscript.
- **Conflicts of interest:** There are no conflicts of interest.
- **Financial support and sponsorship:** None.

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