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# Cesarean section rates in each region of Greece: A retrospective analysis

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## Abstract

**Introduction:** There is a national trend in increasing cesarean section rates in Greece. The purpose of this study was to determine the frequency of cesarean sections per district of the Greek territory.

**Materials and Methods**: In this retrospective observational study, the records of all births in Greece between 2019-2020 from the official archives of the Hellenic Statistical Authority were processed and analyzed. The NUTS-1 classification according to the EUROSTAT was used for the division of the Greek territory into districts. Based on this classification, Greece is divided into four major districts: Northern Greece, Central Greece, Attica and Aegean Islands-Crete.

**Results**: In total, 169,417 births were recorded in Greece during the two-year period from 1/1/2019 to 31/12/2020. Of these, 55.79% were performed by cesarean section, 40.24% by vaginal delivery, 0.02% by a combination of vaginal delivery and cesarean section, while the mode of procedure was not reported in 3.95% of all deliveries. The highest frequency of cesarean sections was observed in Attica with a rate of 58.86%. The corresponding rates in the other districts were 55.50% (Aegean Islands and Crete), 53.55% (Northern Greece) and 51.49% (Central Greece). Notably, the mode of delivery was not reported in 13.75% of births in Central Greece, while the respective rates in the other districts ranged between 1.02% and 2.1%.

**Conclusions**: The frequency of cesarean sections in Greece was high, with a rate of 55.79% of all births, during the study period. The district with the highest frequency of cesarean section was Attica, with a rate over 58%.

**Key Words:** Cesarean section, rates, delivery, Greece, Eurostat

## Introduction

Cesarean section is the oldest abdominal surgery and at the same time the most frequent operation during pregnancy. It is described as a life-saving surgery, performed when various complications occur

during pregnancy or labor. During cesarean section, the neonate and the placenta are withdrawn from the uterus after transection of the abdominal wall and uterus, which are then carefully sutured.[1] Undoubtedly, the possibility of saving both the mother and newborn through cesarean section is one of the greatest achievements of modern medical science. However, similar to all surgical operations, cesarean section is not without possible complications which could affect the life of the mother and/or the neonate or subsequent pregnancies.[2,3] The results of several studies, conducted in Asia, Europe, the USA and Latin America, agree that perinatal morbidity and mortality are higher when delivery is performed by cesarean section compared to those during non-invasive spontaneous vaginal deliveries.[3-5]

In the context of a meeting organized by the World Health Organization (WHO) in 1985 in Fortaleza, Brazil, a group of human reproduction experts stated that a cesarean section rate of more than 10 -15% of all births cannot be justified in any region.[6] Reproductive experts had reached to this conclusion after careful review of the available at the time limited data from mainly northern European countries, according to which, with the existing cesarean section rates, perinatal outcomes were satisfying.[7] Since then, a global discussion has started aiming on the reduction of cesarean section rates. However, over the following years, cesarean section rates increased in both high and low Human Development Index (HDI) countries.[1,8] Notably, the goal of maintaining the rate of cesarean sections between 10% and 15% of all births, which was considered ideal, was severely criticized as it was based on limited data from specific countries without taking into account the particularities (geographical, political, socio-economic) of each country or geographical region.[9] This resulted in a review of the previous "problematic" initial goal on the ideal rate of cesarean sections, by WHO, almost 30 years later, and a conclusion that it is preferable that global efforts focus on offering cesarean section to every pregnant woman that needs it, rather than achieving a specific percentage.[7,9]

In Greece, the rate of cesarean sections among all births has reached particularly high levels. However, until recently, there was no systematic recording of the total population to allow safe conclusions and comparisons between geographical compartments. The mountain masses and the numerous island formations make Greece a country with geographical challenges. The purpose of this retrospective observational study was to record the frequency of cesarean sections per region of the Greek territory and identify possible geographical contributors in the rate of cesarean sections.

## Materials and methods

### *Study design*

The present study is a retrospective observational study, which was based on data collected by the Hellenic Statistical Authority (ELSTAT). The registered birth reports of two years (2019 and 2020) from the official ELSTAT archive were used. At the time this study was conducted, reports for previous or subsequent years were not available.

For the division of the Greek territory, EUROSTAT classification was used, according to NUTS -1 (Nomenclature of Territorial Units for Statistics / Level NUTS -1), based on the 2020 edition. The NUTS classification has been used in European Union legislation since 1988 and was codified in an official regulation of the European Parliament and Council in 2003. According to the NUTS -1 classification, Greece is divided in four large regions:[10]

1. **EL 3 (Attica):** Athens North Sector, Athens West Sector, Athens Central Sector, Athens South Sector, East Attica, West Attica, Piraeus, Attica Islands.
2. **EL 4 (Aegean Islands and Crete):** Lesbos, Limnos, Ikaria, Samos, Chios, Kalymnos, Karpathos, Kasos, Kos, Rhodes, Andros, Thira, Kea, Milos, Mykonos,

Naxos, Paros, Syros, Tinos, Crete.

3. **EL 5 (Northern Greece):** Evros, Xanthi, Rhodope, Drama, Thassos, Kavala, Imathia, Thessaloniki, Kilkis, Pella, Pieria, Serres, Halkidiki, Grevena, Kozani, Florina, Arta, Preveza, Thesprotia, Ioannina.
4. **EL 6 (Central Greece):** Karditsa, Trikala, Larissa, Magnesia, Sporades, Zakynthos, Corfu, Ithaca, Kefalonia, Lefkada, Aetoloakarnania, Achaia, Ilia, Boeotia, Evia, Evrytania, Fthiotida, Phocis, Argolis, Arcadia, Corinth, Laconia, Messinia.

### *Bioethics*

This study was conducted in compliance with applicable national regulatory requirements governing the conduct of research of this type. Additionally, the design and conduct of the study was in compliance with the ethical principles set forth in the Declaration of Helsinki. The researcher acted in accordance with the principles of the Ethics Committee of the Department of Medicine of the Aristotle University of Thessaloniki.

### *Statistical analysis*

The evaluation and analysis of the data involved mainly descriptive statistics while quantitative data were used. Due to the large amount of data, it was grouped into a small number of groups, so that the researcher can use and analyze the grouping of the Greek Statistical Authority. In this way there was no loss of information from the original (primary) data. The IBM SPSS version 27 software program was used to collect and process the data.

## Results

Based on statistical analyses, the total number of births in the entire Greek territory was 169,417, for the years 2019 and 2020 (Source: ELSTAT). The total number of deliveries was separated by year, region and type of delivery (vaginal delivery / cesarean section). Descriptive statistics highlighted the number of births in each district and were as follows (Figure 1):

- Northern Greece (BE): n =44,509 (26.27%)
- Central Greece (CE): n =29,322 (17.31%)
- Attica (Att): n=75.376 (44,49 %)
- Aegean Islands and Crete (NA and K): n=20,210 (11.93%)

There were large differences between the numbers of births that took place by region. About 9 out of 20 births in the Greek territory took place in Attica, slightly more than 5 out of 20 took place in Northern Greece, about 3.5 out of 20 took place in Central Greece and just under 2.5 out of 20 took place in the Aegean Islands and Crete.

The breakdown of births per year was as follows:

- 2019: n=84,210 (49.7%)
- 2020: n = 85,207 (50.3%)

By using Chi-square test to compare the 84,210 births recorded in 2019 with the 85,207 recorded in 2020, we found that there was statistically significant difference between the birth rates of 2019 and 2020 (p = 0.015).

Regarding mode of delivery, the following were

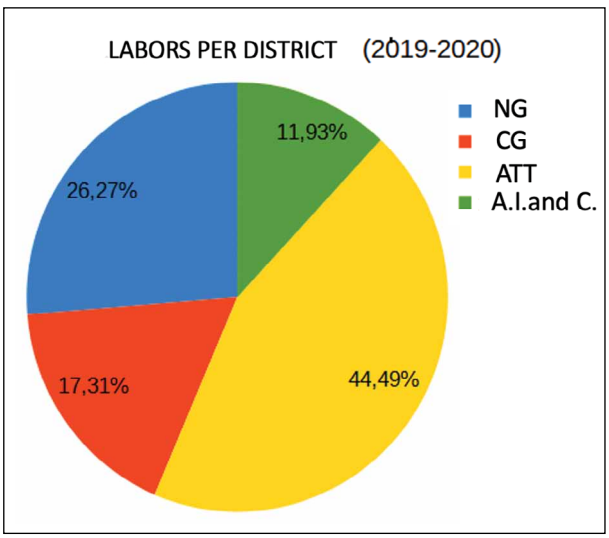


***Figure 1.*** Deliveries per district of Greece.

recorded from all the births (Figure 2):

- Vaginal deliveries (VD): n=68,169 (40.24%)
- Cesarean deliveries (CS): n=94,521 (55.79%)
- Deliveries with a combination of vaginal delivery and cesarean section (VD-CS): n=35 (0.02%).

Mode of delivery not recorded (NR): n=6,692 (3.95%) For the two studied years 2019-2020, the frequency of births by region and type of birth was (Figure 3):

- *Northern Greece:* A total of 44,509 births were recorded. Of these, 23,836 (53.55%) were performed by cesarean section (CS), 19,796 (44.48%) by vaginal delivery (VD), 10 (0.02%) by combined vaginal delivery and cesarean section (VD-CS) while no type of delivery (NR) was recorded in 867 (1.95%) deliveries.
- *Central Greece:* A total of 29,322 births were registered. Of these, 15,099 (51.49%) were performed by CS, 10,190 (34.75%) by VD, while no type of delivery was declared in 4,033 (13 .75%) deliveries.
- *Attica:* A total of 75,376 births were recorded. Of these, 44,369 (58.86%) were performed by CS, 29,401 (39.01%) by VD, 21 (0.03%) by combined

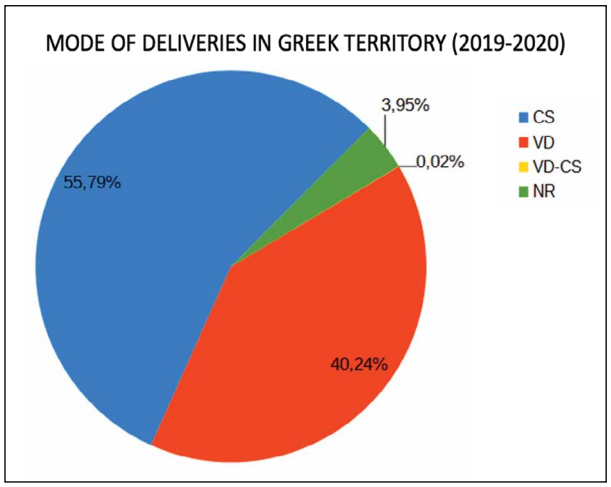


***Figure 2.*** Mode of delivery during the study period.

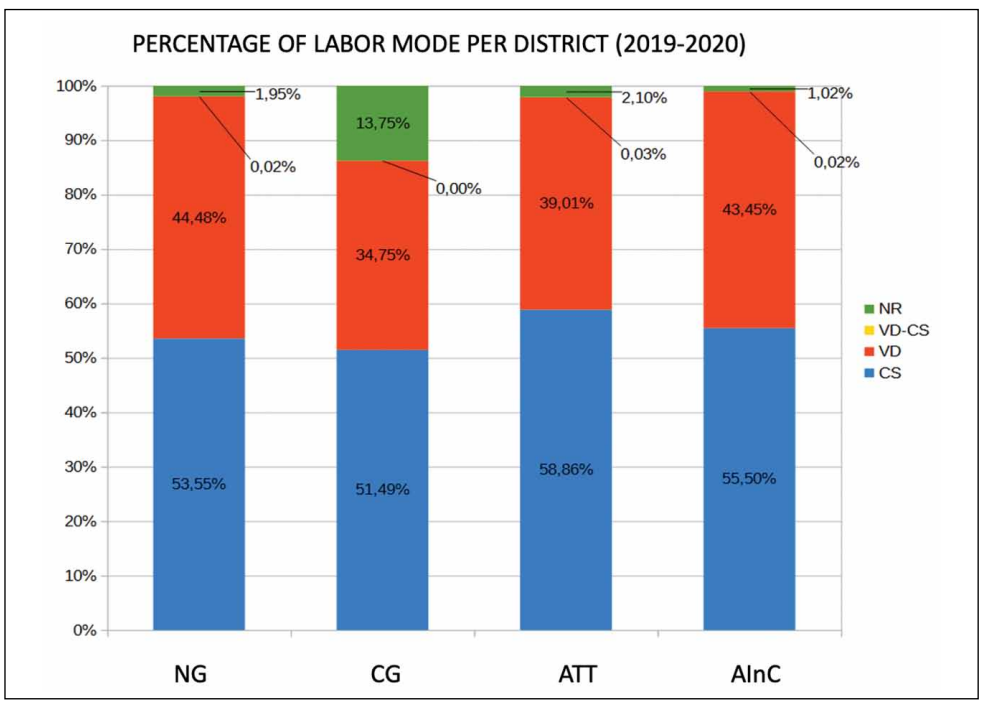


***Figure 3.*** Delivery mode per district.

VD-CS while no type of delivery was reported in 1,585 (2.10%) deliveries.

- *Aegean Islands and Crete:* A total of 20,210 births were recorded. Of these, 11,217 (55.50%) were performed by CS, 8,782 (43.45%) by VD, 4 (0.02%) by combined VD-CS while no type of delivery was recorded in 207 (1.02%) deliveries.

It is noteworthy that, in a large part of the deliveries that took place in Central Greece, the method of labor was not declared. Specifically, in 13.75% of the births that took place in this region, the method of delivery was not recorded, while the corresponding percentages for the rest of the regions ranged between 1.02% and 2.10%.

To investigate whether there is a statistically significant difference between the rates of cesarean sections of each region no statistically significant difference between them was found (p=0.892). In addition, in 3.95% of deliveries, the mode was not declared, which could affect the results of the study. Moreover, it was examined whether there was a statistically significant difference between the birth rates of each district, for which no mode of delivery was declared. Using the Chi-square test, it was found that there is a significant difference between the rates of deliveries of each district, for which no mode of delivery was declared at the level of statistical significance of 1% (p <0.001).

Since in a fairly large percentage of births in Central Greece (13.75%) the method of delivery was not declared, while in the rest of the regions the corresponding percentages ranged between 1.02% and 2.10%, the same test was repeated without including the data of Central Greece. It was found that there is no statistically significant difference between the birth rates of Northern Greece, Attica and the Aegean-Crete Islands (p=0.819). This indicates that the non-declaration of delivery mode in 13.75% of deliveries in Central Greece is a strong confounder for the statistical analyses.

Of major importance was the recording of the frequency of stillbirths. The total number of stillbirths was 894 and corresponded to 0.53% of all deliveries for the two years 2019-2020 (Figure 4). Their frequency by region and type of delivery was:

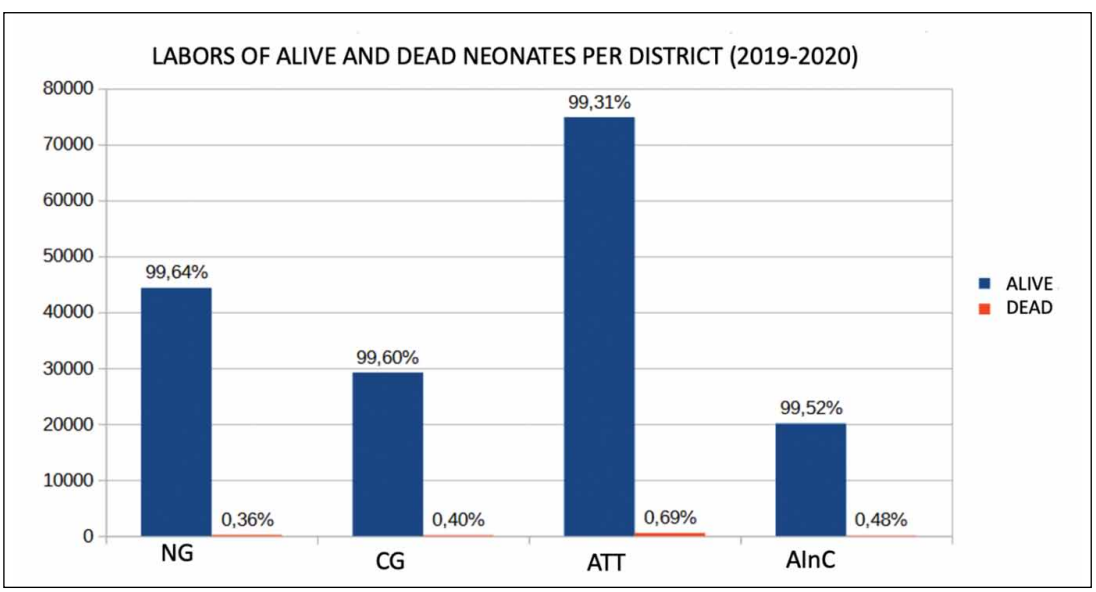


***Figure 4.*** Delivery of alive and stillbirths per district.

- *Northern Greece:* A total of 162 stillbirths were recorded (0.36% of births in the region). Of these, 95 (58.64%) were performed by CS, 64 (39.51%) by VD, while no type of delivery was declared in 3 (1.85%) births.
- *Central Greece:* A total of 117 stillbirths were recorded (0.40% of births in the region). Of these, 53 (45.30%) were performed by CS, 38 (32.48%) by VD, while no type of delivery was declared in 26 (22.22%) births.
- *Attica:* A total of 519 stillbirths were recorded (0.69% of births in the region). Of these, 278 (53.56%) were performed by CS, 224 (43.16%) by VD, 3 (0.58%) by a combination of VD-CS while no type of delivery was declared in 14 (2.70%) deliveries.
- *Aegean Islands and Crete:* A total of n=96 stillbirths were recorded (0.48% of births in the region). Of these, 61 (63.54%) were performed by CS and 35 (36.46%) by VD.

## Discussion

During the years 2019 and 2020, a total of 169,417 live births and stillbirths took place in the Greek territory. Of these, 55.79% were performed by cesarean section, 40.24% were performed vaginally, while in 3.95% of the deliveries the method of delivery was not recorded. A very small percentage (0.02%) was carried out with a combination of vaginal delivery and cesarean section and according to ELSTAT's clarification, it concerned multiple pregnancies, where at least one newborn was delivered vaginally and at least one newborn was delivered by cesarean section. It is known that in the case of a twin pregnancy, following the delivery of the presenting twin vaginally, the second may need to be delivered by emergency cesarean section.[11]

The highest frequency of cesarean section application was observed in the region of Attica, followed by the regions of the Aegean Islands and Crete, Northern Greece and Central Greece. The lower incidence of cesarean section in Central Greece compared to its incidence in the rest of the regions, may be due to the particularly high rates of deliveries whose mode was not declared in this region. Specifically, in Central Greece, the method of delivery was not declared in 13.75% of all births in the region, while in all other regions the frequency of deliveries, where the method of delivery was not declared, ranged from 1.02% to 2.10% of all births in the respective regions.

Examining only the registration of births in the year 2020, where births for which the method of delivery was not declared were considerably less, the highest incidence of cesarean section was recorded in Attica, with a percentage of 60.22%, followed by Central Greece, the Aegean Islands and Crete and Northern Greece with percentages of 57.51%, 55.60% and 54.56% respectively. For the year 2020, the highest frequency of births without recording mode of delivery appeared in Central Greece with a percentage of 4.63% of births in the region, while for the rest of the regions the frequency of births without recording the way of labor ranged between 0.18% and 0.44%.

The percentage of deliveries, which were carried out by a combination of vaginal delivery and cesarean section and related exclusively to multiple pregnancies, was 0.02% of all deliveries in the Greek territory for the years 2019 and 2020, while also varying at very low levels per region (from 0.00% to 0.03% of all births in each region).

The present study confirmed the assessment of the European Department of WHO about a frequency of more than 50% of all births in Greece.[12] According to the Perinatal Health Report of the Euro-Peristat Network for the year 2015, the highest rates of cesarean sections in the European Union came from Cyprus (56.90%) while Greece was the only country in the European Union that had never submitted data to the Euro-Peristat Network on delivery mode.[13] The

present study shows that Greece, with a cesarean section rate of 55.79%, occupies one of the highest positions in the European Union regarding the frequency of cesarean sections. In fact, the rate of cesarean sections in Greece is more than twice the 27%, which is the median of the European Union[13] and similar to the rate of cesarean sections in Brazil (55.8%), which records one of the highest frequencies of cesarean sections in the world.[14]

Several factors seem to have contributed to the increase in the frequency of cesarean sections in almost the entire planet and possibly in Greece. In recent decades, the number of women achieving pregnancies late in their reproductive years has increased. Advanced maternal age at delivery appears to be an independent factor increasing the rate of cesarean sections.[15] Furthermore, infertility is associated with the patient's age. This means that as a patient ages, the incidence of infertility increases and, by extension, the need to apply assisted reproduction methods.[16] Pregnancies achieved by in vitro fertilization are more likely to terminate by cesarean section than pregnancies resulting from spontaneous conception.[17] More often nowadays, than in the previous decades, a delivery with a fetus in breech presentation is performed by cesarean section rather than vaginally after external transformation or vaginally in breech presentation without external transformation.[18] In addition, Women from higher socio-economic levels are more likely to turn to the private sector for their obstetric care and to proceed to labor by cesarean section.[19] Moreover, obstetrics ranks among the medical specialties that are quite often involved in litigation.[20] This has the consequence that cesarean sections are performed more and more often with the aim of protecting the obstetrician from a potential legal dispute rather than benefiting the pregnant woman.[21] Furthermore, several non-medically indicated cesarean sections are performed around the world at the request of the pregnant woman. The insufficient information of the patient, the experience of a previous traumatic birth, the fear of sexual dysfunction after childbirth, the fear of pain during vaginal delivery, the anxiety of the vaginal examination are some of the reasons that a patient requests to deliver by cesarean section while despite the absence of a medical indication.[22]

Within the Greek territory and for the years 2019 and 2020, the highest incidence of cesarean sections was recorded in the wider area of the capital of the state, with a percentage of 58.86% while in the same area the percentage of cesarean sections was 60.22% for the year 2020. The causes of the extremely high cesarean section rates recorded in the Attica region are not clear. However, at least eight high-quality Neonatal Intensive Care Units (NICUs) operate in the capital. Therefore, Athens is a very good choice to deliver a high-risk pregnancy in one of its maternity hospitals, as the neonate may require support in the NICU after delivery. It is noted that in Athens, many high-risk pregnancies seek medical care from neighboring areas, belonging to other regions (Central Greece, Aegean Islands-Crete), which lack a satisfactory neonatology infrastructure. High-risk pregnancies, especially those complicated by prematurity, are often managed by cesarean section.[23] In addition, many assisted reproduction centers operate in Athens, serving infertile couples from all over the Greek territory. Several pregnancies resulting from IVF are multiple and will be delivered by cesarean section. Infertile couples who achieve pregnancy through IVF and live in the region of Attica will probably give birth in one of the maternity hospitals in Athens. Many of the couples who achieve pregnancy through IVF in one of the assisted reproduction centers in Athens and do not live in the Attica region, may choose to give birth in one of the maternity hospitals in Athens based on the sense of security that is conveyed but also under

the influence of the prevailing Athenian-centric culture. Another possible reason for the high cesarean section rates in the region of Attica is the large number of deliveries which are performed in private maternity hospitals. In Athens, there are four high-standard private maternity hospitals, which are estimated to handle more than 20,000 births per year. According to an earlier study, a higher frequency of cesarean sections was observed in the private maternity hospitals of Athens compared to the public hospitals of the same region.[24]

Although more studies, which in the future could include records of more years, would reveal the trend of the frequency of cesarean sections in Greece, the necessity of establishing protocols by the health and scientific bodies is evident, to reduce the non-medically indicated cesarean sections in Greece. In recent years, the action of the Hellenic Society of Obstetrics and Gynecology (HSOG) has been oriented in this direction with the creation and publication of guidelines on cesarean section, induction of labor and vaginal delivery after cesarean section. Measures that would potentially contribute to the reduction of non-medically indicated cesarean sections, include the continuing education of obstetricians and obstetricians / midwives through repeated and updated educational activities as well as the upgrading of the role of obstetricians/midwives. Also, there is an urgent need for more complete records of the epidemiological data, to limit the confusing factor of deliveries, for which the mode is not recorded. Notably, significant progress has been made as this rate decreased from 6.84% to 1.10% between the years 2019 and 2020.

With regards to the limitations of this study, the lack of adequate data of the delivery method in 3.95% of all births in the Greek territory for the years 2019 and 2020 and mainly in Central Greece, which exceeded 13% of the births in this region, was a limitation. Moreover, the data obtained from the ELSTAT, did not contain information about the indications for cesarean sections and therefore it was not possible to determine the possible non-medically indicated cesarean sections. For example, the frequencies of multiple pregnancies and previous cesarean sections, which constitute indisputable medical indications for cesarean section although part of them could be handled by vaginal delivery,[11,25] possibly show a different dispersion by geographical region. Therefore, not specifying the indications for performing cesarean sections was another limitation of the study. A further limitation of the present study was the limited number of years available. Until the timing of this study, ELSTAT did not have at its disposal information on the mode of deliveries for years other than 2019 and 2020. If the present study had records of more years at its disposal, safer conclusions could, possibly, be drawn.

## Conclusion

Following the first official recording by ELSTAT, the relatively high rate of cesarean sections in Greece was highlighted, in all geographical areas. The present study intents to raise awareness on this important public health issue. According to the recommendation by WHO, the National Health System, the HSOG and all other involved societies should look for the root causes of the problem and promote an action plan, which will aim to limit the performance of unnecessary cesarean sections only to cases where it is required, in order to protect the health of the mother and the fetus-neonate.

## Disclosure of conflicts of interest:

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## References


1. Betran AP, Ye J, Moller AB, Zhang J, Gulmezoglu AM, Torloni MR. The Increasing Trend in Caesarean Section Rates: Global, Regional and National Estimates: 1990-2014. PLoS One. 2016;11:e0148343.
2. Gregory KD, Jackson S, Korst L, Fridman M. Cesarean versus vaginal delivery: whose risks? Whose benefits? Am J Perinatol. 2012;29:7-18.
3. Lumbiganon P, Laopaiboon M, Gulmezoglu AM, et al. Method of delivery and pregnancy outcomes in Asia: the WHO global survey on maternal and perinatal health 2007-08. Lancet. 2010;375:490-9.
4. Villar J, Carroli G, Zavaleta N, et al. Maternal and neonatal individual risks and benefits associated with caesarean delivery: multicentre prospective study. BMJ. 2007;335:1025.
5. Villar J, Valladares E, Wojdyla D, et al. Caesarean delivery rates and pregnancy outcomes: the 2005 WHO global survey on maternal and perinatal health in Latin America. Lancet. 2006;367:1819-29.
6. World Health Organisation. Appropriate technology for birth. Lancet. 1985;2:436-7.
7. World Health Organisation. WHO statement on cesarean section rates. World Health Organization; 2015.
8. Vogel JP, Betran AP, Vindevoghel N, et al. Use of the Robson classification to assess caesarean section trends in 21 countries: a secondary analysis of two WHO multicountry surveys. Lancet Glob Health. 2015;3:e260-70.
9. Betran AP, Torloni MR, Zhang JJ, Gulmezoglu AM, Section WHOWGoC. WHO Statement on Caesarean Section Rates. BJOG. 2016;123:667-70.
10. European Commission, Statistical Office of the European Union. Statistical regions in the European Union and partner countries: NUTS and statistical regions 2021: 2020 edition.
11. Tsakiridis I, Giouleka S, Mamopoulos A, Athanasiadis A, Dagklis T. Management of Twin Pregnancies: A Comparative Review of National and International Guidelines. Obstet Gynecol Surv. 2020;75:419-30.
12. Greece commits to addressing excessive reliance on cesarean sections https://www.euro.who.int/en/countries/greece/news/news/2016/11/greece-commits-to-addressing-excessive-relianceon-cesarean-sections (accessed Sep 26, 2021).
13. European Perinatal Health Report 2015–Euro-Peristat https://www.europeristat.com/images/EPHR2015_web_hyperlinked_Euro-Peristat.pdf (accessed Apr 17, 2022).
14. Rudey EL, Leal MDC, Rego G. Cesarean section rates in Brazil: Trend analysis using the Robson classification system. Medicine (Baltimore). 2020;99:e19880.
15. Bayrampour H, Heaman M. Advanced maternal age and the risk of cesarean birth: a systematic review. Birth. 2010;37:219-26.
16. Crawford NM, Steiner AZ. Age-related infertility. Obstet Gynecol Clin North Am. 2015;42:15-25.
17. Lodge-Tulloch NA, Elias FTS, Pudwell J, et al. Caesarean section in pregnancies conceived by assisted reproductive technology: a systematic review and meta-analysis. BMC Pregnancy Childbirth. 2021;21:244.
18. Tsakiridis I, Mamopoulos A, Athanasiadis A, Dagklis T. Management of Breech Presentation: A Comparison of Four National Evidence-Based Guidelines. Am J Perinatol. 2020;37:1102-9.
19. Arrieta A. Health reform and cesarean sections in the private sector: The experience of Peru. Health Policy. 2011;99:124-30.
20. Jena AB, Seabury S, Lakdawalla D, Chandra A. Malpractice risk according to physician specialty. N Engl J Med. 2011;365:629-36.
21. Kitzinger S. Sheila Kitzinger's letter from Europe: the cesarean epidemic in Great Britain. Birth. 1998;25:56-8.
22. Jenabi E, Khazaei S, Bashirian S, Aghababaei S, Matinnia N. Reasons for elective cesarean section on

maternal request: a systematic review. J Matern Fetal Neonatal Med. 2020;33:3867-72.
23. Malloy MH. Impact of cesarean section on intermediate and late preterm births: United States, 2000-2003. Birth. 2009;36:26-33.
24. Mossialos E, Allin S, Karras K, Davaki K. An investigation of Caesarean sections in three Greek hospitals: the impact of financial incentives and convenience. Eur J Public Health. 2005;15:288-95.
25. Tsakiridis I, Mamopoulos A, Athanasiadis A, Dagklis T. Vaginal Birth After Previous Cesarean Birth: A Comparison of 3 National Guidelines. Obstet Gynecol Surv. 2018;73:537-43.

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