European Journal of Obstetrics and Gynecology 318 (2026) 114921

Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.journals.elsevier.com/european-journal-of-obstetrics-and-gynecology-and-reproductive-biology

Caesarean section rates in public vs private hospitals in Europe: a systematic review and meta-analysis using the Robson ten group classification system

Sara Ebadi[a,*], Viktoria El Radaf[a,b], Tahir Mahmood[c,d], Charles Savona-Ventura[e], Mehreen Zaigham[a,f]

[a] Obstetrics and Gynaecology, Institution of Clinical Sciences Lund, Lund University, Sweden
[b] Department of Obstetrics and Gynaecology, Ystad Hospital, Ystad, Sweden
[c] Spire Murrayfield Hospital, Edinburgh, Scotland, UK
[d] Chair Standing Committee Standards of Care and Position Statements, EBCOG, UK
[e] Department of Obstetrics & Gynaecology, Centre of Traditional Medicine & Culture, Faculty of Medicine & Surgery, University of Malta, Malta
[f] Department of Obstetrics and Gynaecology, Skåne University Hospital, Malmö, Sweden

ARTICLE INFO

Keywords:
Caesarean section
Childbirth
Emergency
Epidemiology
Europe
European region
EBCOG
Global health
Maternal and child health
Maternal morbidity
Meta-analysis
Neonatal outcome
Private hospitals
Public hospitals
Regional
Robson classification
Robson ten group classification system
Systematic review
Ten group classification system
Variation in clinical practice

ABSTRACT

Introduction: Since the last two decades, there has been a dramatic rise in caesarean sections (CS) throughout the world. This increase has been seen even in Europe, where rates vary significantly from 17% in Northern Europe to 56% in the South. Although, CS can be a lifesaving intervention when medically necessary, non-essential CS are associated with short- and long-term complications for both the mother and newborn. To curb this rising trend, it is important to understand underlying causes behind regional disparities, including differences between public and private hospitals.

Objective: To investigate variations in CS rates between public and private hospitals across European regions and at a country level using the Robson Ten Group Classification.

Methods: A systemic review of studies published between 1st January 2000 and 12th March 2025 was conducted using MEDLINE/PubMed, CINAHL, EMBASE, Global Index Medicus, Web of Science and Cochrane library, analysing CS rates in 25 European countries. All studies reporting births in Europe, Robson group, written in English or Swedish were included. The developed protocol was prospectively registered in PROSPERO (Registration number 513579). Meta-analysis using absolute numbers and percentages was conducted to compare the birth rates at country and regional levels. To assess the risk of bias, two reviewers independently evaluated the quality of the studies included using a modified Newcastle–Ottawa Scale adapted for cohort studies.

Results: Of 1385 articles, 46 were eligible for inclusion in the final analysis. A total of 12 505 939 births were analysed, with 8 543 803 (68.3%) occurring in public hospitals and 3 962 136 (31.7%) in private hospitals. Overall, Southern Europe illustrated the highest CS rate (54.9% of all births) as compared to Northern Europe (16.9%). There was a lack of reporting from private hospitals, with data only for Southern Europe, where CS rates were significantly higher in private (73.1%) as compared to public (40.9%) hospitals. The largest differences were seen for low-risk women Robson Group 1, 2, 3 and 4 (private vs public: 67.8 vs 28%, 67.6 vs 39.7, 26.9 vs 9.1% and 38 vs 18% respectively).

Conclusion: High CS rates were observed across Europe, with Southern Europe reporting the highest levels. Rates were consistently higher in private compared to public hospitals. In both settings, Group 5 (women with a previous CS) was the largest contributor to the overall CS rate. However, low-risk women in private hospitals (Groups 1 and 2) had twice the CS rates compared with public hospitals. These findings highlight that the excess CS burden in private hospitals is largely driven by unnecessary procedures in low-risk groups. There is an urgent need for interventions that promote evidence-based care and reduce unnecessary CS especially among low-risk women.

* Corresponding author at: Department of Obstetrics & Gynaecology, Institution of Clinical Sciences Lund, Lund University, Sweden.
E-mail address: sara.ebadi@med.lu.se (S. Ebadi).

https://doi.org/10.1016/j.ejogrb.2025.114921
Received 5 October 2025; Received in revised form 21 December 2025; Accepted 24 December 2025
Available online 25 December 2025

Introduction

In the last two decades there has been a dramatic rise in caesarean section (CS) rates throughout the world. Europe is one of the regions facing this challenging phenomenon [1]. While CS can be a lifesaving intervention when medically indicated, non-essential CS can result in unnecessary maternal-newborn complications both in the short- and long-term [2,3]. CS is one of the most performed surgical interventions worldwide with 1 in 5 women undergoing a CS [4]. This number is expected to rise to 1 in 3 (29 %) women by 2030 [4].

CS rates vary widely between and within countries depending on the health sector policies, practices and healthcare quality. For instance, according to the Organisation for Economic Co-operation and Development (OECD), in 2022 the highest CS rate in Europe was reported by Turkey, a striking 60 %, while the lowest was reported in Iceland 14.9 % followed by the Netherlands (15.4 %) and Norway (16 %) [1]. It is crucial to understand the underlying causes behind these significant disparities to be able to tackle the challenging overuse of CS. One of the factors affecting the rates could be the presence of private institutions performing CS. Hospitals in Southern/Central Europe have a mixed public–private healthcare sector whereas in Western and Nordic Europe, healthcare is predominantly public [5]. It was reported by Eyi et al. that 44 % of births performed in Turkey in 2017 occurred in private hospitals where the CS rate was 70 % [6].

In 2015, the World Health Organization (WHO) proposed the use of the Robson classification, also known as the 10-group classification or ten groups classification system, to help simplify, standardise, and allow comparisons of groups of women driving rising CS rates globally [7].

Hence, the objective of our review was to investigate absolute differences in CS rates between public and private hospitals in Europe and to compare groups of women according to the Robson classification to discern trends.

Methods

Study design

The study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement [8], and the completed checklist is provided as **Supplementary Information 1**. The developed protocol was registered in PROSPERO (Registration number 513579).

Data sources & search strategy

A systemic literature search was carried out by an experienced librarian at Lund University, Sweden, using MEDLINE/PubMed, CINAHL EMBASE, Web of Science, Cochrane library, African Index Medicus via Global Index Medicus CAB (World Health Organization) and Latin American and Caribbean Health Sciences Literature (LILACS) via Global Index Medicus (World Health Organization) (**Supplementary Information 2**).

The following terms were used in the search: “Robson classification”, “Robson 10 classification”, and “Robson criteria”. All studies identified by the search were later uploaded to Covidence, a systemic review software [9].

Eligibility criteria

All studies published from 1st January 2000 to 12th March 2025 were included in the search strategy. Studies written in languages other than English or Swedish were excluded as well as studies with births outside of the European region. Turkey was included as it was considered a transcontinental country.

Study selection

Four authors (SE, VER, MZ) independently: i) screened titles and abstracts of studies identified by the literature search; and ii) assessed their suitability for inclusion in the review. Any discrepancies or information conflicts was resolved by discussion between the authors. Full texts of each selected study were thereafter reviewed for potential eligibility. Any discrepancies about the inclusion/exclusion of any study were discussed with a senior author (MZ).

Data analysis

Data from the eligible studies were extracted using a pre-defined protocol with the REDCap data management system. Extracted data items included: authors, year of publication, country, study design, healthcare setting (public vs. private), study duration, total sample size, number of vaginal births, number of caesarean sections, absolute and relative group sizes based on the Robson classification, indications for caesarean births, and any reported adverse perinatal outcomes. Although data for the latter two variables were extracted, they were not analysed or discussed in the manuscript, as they fell outside the primary objective of the review, which focused specifically on examining caesarean section rates by Robson group. Studies were grouped into four European regions: Nordic Europe, Western Europe, Southern Europe, and Central-Eastern Europe [10]. Any discrepancies in the extracted data were resolved through group consensus discussions and by discussion with a senior author (MZ).

Risk of bias in individual studies (quality assessment)

Two reviewers independently evaluated the quality of the studies included in the primary *meta*-analysis, applying a modified version of the Newcastle-Ottawa Scale tailored for cohort studies [11]. Any discrepancies in assessments were resolved through detailed discussion until agreement was reached. The scale assesses the studies based on three domains: selection, comparability, and outcomes. For selection, four stars in total could be awarded, one for each subdomain. In our assessment studies including all births in the country, studies providing data for both vaginal and caesarean births, studies giving detailed information for each Robson group, and studies where the outcome was not present at the start were given all four stars. For comparability, studies that compared the Robson groups for at least two time-points were given two stars. Finally, within the ‘outcomes’ domain, one star was awarded for ‘assessment of outcomes’ when data for all Robson groups were reported. Additional stars for ‘length of follow-up’ and ‘adequacy of follow-up’ were granted if any neonatal or maternal outcomes were provided.

Synthesis of results

We conducted a *meta*-analysis of proportions, pooling the proportion of caesarean sections within each Robson group across studies using sample-size–weighted estimates, in line with established epidemiological methods for prevalence data [12,13]. Since all studies included in this review utilised the Robson classification system, we conducted a *meta*-analysis by calculating the overall effect size for each Robson group, further stratified by European region. In cases where only percentages were reported, absolute numbers were derived by multiplying the total sample size by the given percentage to estimate the number of individuals in each group. The total numbers of CS and vaginal births were determined by summing the figures of the individual Robson groups. Robson group sizes for continuous outcomes were calculated using pooled absolute values. For multi-country studies, data were extracted at the country level and reported separately for each country. A list of assumptions made during data extraction are included as **Supplementary Information 3**. All statistical analyses were conducted

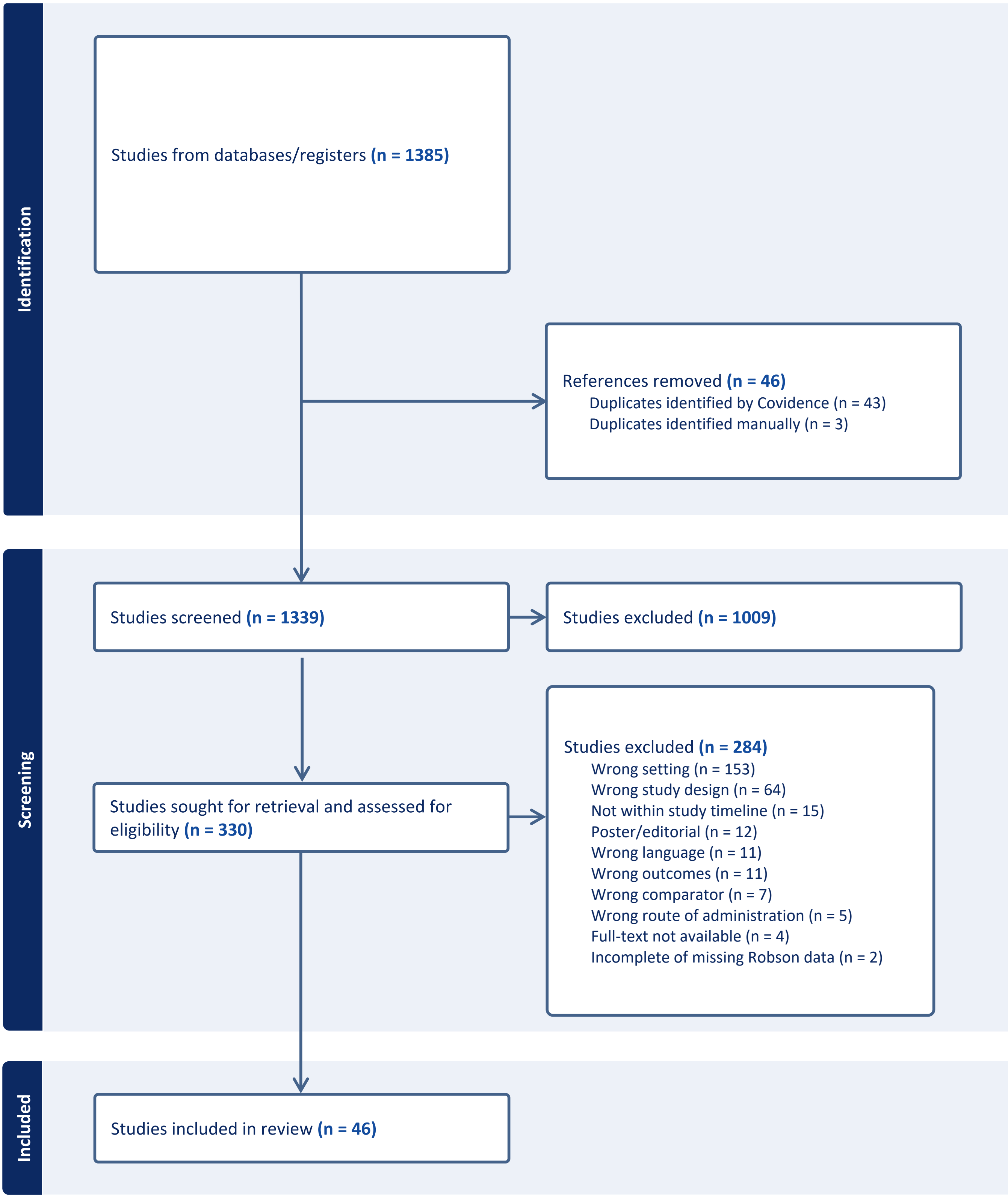

Fig. 1. PRISMA flow diagram of studies included in the review.

using Microsoft Excel and Stata (Stata Statistical Software: College Station, TX: StataCorp LP).

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The study was supported by the European Board & College of Obstetrics and Gynaecology (EBCOG).

Table 1
Characteristics of the studies included in the review.

First Author, Year	Country	Type of Study	Study duration	Population Characteristics	Reasons for Caesarean section	Reported Perinatal Outcomes
Nordic Europe, 15 studies (Denmark, Finland, Iceland, Norway and Sweden)						
Amyx 2023	Denmark	Cross-sectional	01–2015 to 12–2015, 01–2018 to 12–2018	All births in Denmark	NA	NA
Amyx 2023	Finland	Cross-sectional	01–2015 to 12–2015, 01–2019 to 12–2019	All births in Finland	NA	NA
Amyx 2023	Iceland	Cross-sectional	01–2015 to 12–2015, 01–2019 to 12–2019	All births in Iceland	NA	NA
Amyx 2023	Norway	Cross-sectional	01–2015 to 12–2015, 01–2019 to 12–2019	All births in Norway	NA	NA
Amyx 2023	Sweden	Cross-sectional	01–2015 to 12–2015, 01–2019 to 12–2019	All births in Sweden	NA	NA
Laine 2023	Norway	Retrospective	01–1999 to 12–2018	All births in Norway	NA	Perinatal mortality, Apgar $<$ 7 at 5 mins
Muraca 2022	Sweden	Retrospective	01–2004 to 12–2016	All births in Sweden	NA	Pre-eclampsia
Savchenko 2022	Sweden	Prospective	01–2017 to 12–2020	All births in Sweden	NA	Postpartum haemorrhage, Apgar $<$ 7 at 5 mins
Zeitlin 2021	Denmark	Cross-sectional	01–2015 to 12–2015	All births in Denmark	NA	NA
Zeitlin 2021	Finland	Cross-sectional	01–2015 to 12–2015	All births in Finland	NA	NA
Zeitlin 2021	Iceland	Cross-sectional	01–2015 to 12–2015	All births in Iceland	NA	NA
Zeitlin 2021	Norway	Cross-sectional	01–2015 to 12–2015	All births in Norway	NA	NA
Zeitlin 2021	Sweden	Cross-sectional	01–2015 to 12–2015	All births in Sweden	NA	NA
Einarsdóttir 2019	Iceland	Prospective	01–1997 to 12–2015	All births in Iceland	NA	Perinatal mortality, Postpartum haemorrhage, Apgar $<$ 7 at 5 mins
Kempe 2019	Sweden	Cross-sectional	01–2013 to 12–2016	All births at tertiary hospital	NA	Perinatal mortality, Apgar $<$ 7 at 5 mins
Western Europe, 12 studies (Austria, France, Germany, Ireland, Luxemburg, and Switzerland)						
Gantt 2024	Germany	Cross-sectional	01–2018 to 12–2018	All births at Sachsenhausen Hospital	NA	NA
Amyx 2023	Luxembourg	Cross-sectional	01–2015 to 12–2015, 01–2019 to 12–2019	All births in Luxembourg	NA	NA

(continued on next page)

Table 1 (*continued*)

First Author, Year	Country	Type of Study	Study duration	Population Characteristics	Reasons for Caesarean section	Reported Perinatal Outcomes
Amyx 2023	UK Northern Ireland	Cross-sectional	01–2015 to 12–2015, 01–2019 to 12–2019	All births in Northern Ireland	NA	NA
Amyx 2023	UK Scotland	Cross-sectional	01–2016 to 12–2016, 01–2019 to 12–2019	All births at Scotland	NA	NA
Eftekharian 2021	Austria	Retrospective	01–2003 to 12–2013	All births at Medical University of Vienna	NA	Neonatal intensive care unit admission
Pulvermacher 2021	Germany	Prospective	10–2017 to 12–2018	All births at two German hospitals (1 university level, 1 district level)	NA	NA
Bracic 2020	Austria	Retrospective	01–2008 to 11–2019	Births at Medical University of Graz	NA	NA
Crequit 2020	France	Retrospective	01–2012 to 12–2019	Obese vs non-obese	NA	Perinatal Mortality, Neonatal Mortality, Stillbirths, Pre-eclampsia/eclampsia, Neonatal intensive care unit admission, Apgar $<$ 7 at 5 min
Denona 2020	Ireland	Cross-sectional	01–2016 to 12–2016	Births with term, singleton, cephalic nulliparous and multiparous women without previous uterine scar at National Maternity Hospital, Dublin	NA	Post-partum haemorrhage, Blood transfusion, Apgar $<$ 7 at 5 min
Jayot 2016	France	Cross-sectional	01–2002 to 12–2012	Births at Pitié-Salpêtrière Hospital in Paris	NA	NA
Mueller 2014	Switzerland	Retrospective	01–1999 to 12–2009	All births at the University Women's Hospital Bern	NA	NA
Southern Europe, 23 studies (Albania, Cyprus, Italy, Spain and Turkey)						
Shylla 2024	Albania	Retrospective	01–2023 to 05–2023	Births at the University Hospital of Obstetrics and Gynecology	NA	NA
Kinci 2024	Turkey	Retrospective	01–2019 to 12–2022	All births at Muğla University Education and Research Hospital	NA	NA
Abuduxike 2023	Cyprus	Retrospective	01–2019 to 12–2019	All births at the State Hospital in Nicosia	Previous CS, prolonged labour, cephalopelvic disproportion, fetal distress, in-vitro fertilisation, pre-eclampsia, breech, premature rupture of membranes, others maternal comorbidities	NA
Gutiérrez-Martínez 2023	Spain	Cross-sectional	01–2016 to 12–2021	All births at The Leon Hospital	NA	NA
Ulgu 2023	Turkey	Retrospective	01–2018 to 12–2023	All births in Turkey	NA	NA
Sanisoglu 2023	Turkey	Retrospective	01–2016 to 12–2016	All births in Turkey	NA	NA
Birinci 2023	Turkey	Retrospective	01–2022 to 12–2022	All births in Turkey	NA	NA
Golbasi 2023	Turkey	Cross-sectional	01–2013 to 12–2020	Births at the University of Health Sciences, Tepecik Training and Research Hospital	Previous uterine scar, fetal distress, breech, twin or multiple pregnancy, cephalopelvic disproportion, Macrosomia, hypertensive diseases of pregnancy, intrautrerine growth restriction, third-trimester vaginal bleeding	Pre-eclampsia
Keskin 2023	Turkey	Cross-sectional	01–2008 to 12–2020	Births at Ordu University Medical Faculty Training and Research Hospital, Ordu	NA	NA

(*continued on next page*)

Table 1 (*continued*)

First Author, Year	Country	Type of Study	Study duration	Population Characteristics	Reasons for Caesarean section	Reported Perinatal Outcomes
Bulut 2022	Turkey	Cross-sectional	05–2018 to 05–2020	All births at Kayseri Training and Research hospital	Fetal disrtress, breech, twin or multiple pregnancy, malpresentation, cephalopelvic disproportion, macrosomia, hypertensive diseases of pregnancy, failed induction of labour, chorioamnioitis, other pregnancy complications, other fetal indication, other maternal medical complication	NA
Marconi 2022	Italy	Retrospective	01–1996 to 12–2019	All births at San Paolo Hospital in Milano	NA	NA
diPasquo 2022	Italy	Retrospective	01–2014 to 12–2018	All births at University Hospital of Parma	NA	Perinatal mortality, uterine rupture, hysterectomy
Sirico 2022	Italy	Prospective	03–2020 to 11–2021	Mothers undergoing births with positive COVID-19	NA	Maternal intensive care admission
Eyi 2021	Turkey	Cross-sectional	01–2017 to 12–2017	1503 facilities (public, private and university hospitals)	NA	NA
Palacios-Marques 2021	Spain	Cross-sectional	01–2009 to 12–2017	All births at Alicante University Hospital	NA	Perinatal mortality, stillbirths, Apgar $<$ 7 at 5 mins
Topçu 2021	Turkey	Cross-sectional	01–2012 to 12–2017	All births at Zekai Tahir Burak hospital in Ankara	NA	NA
Valladolid 2021	Spain	Retrospective	01–2015 to 12–2017	All births at Basurto University Hospital	NA	NA
Pinto 2020	Spain	Retrospective	01–2015 to 12–2018	Births at Fundación Alcorcón University Hospital	NA	Perinatal mortality, uterine rupture, postpartum haemorrhage, blood transfusion, Apgar $<$ 7 at 5 mins
Strambi 2020	Italy	Retrospective	01–2012 to 12–2017	Births at Careggi University Hospital	Fetal distress, malpresentation, cephalopelvic disproportion, hypertensive diseases of pregnancy, failed induction of labour, intrauterine growth restriction	NA
Vila-Candel 2020	Spain	Retrospective cohort	01–2010 to 12–2018	All births at La Ribera University Hospital in Valencia	NA	NA
Triunfo 2018	Italy	Retrospective	01–1998 to 12–2011	Births in relation to BMI, age and epidural anaesthesia at Fondazione Policlinico Universitario 'A. Gemelli' in Rome	NA	NA
Triunfo 2015	Italy	Cross-sectional	01–1998 to 12–2011	All births in the time period at the GemelliÚniversity hospital in Rome	NA	NA
Ciriello 2012	Italy	Retrospective	01–1994 to 12–2006	Births at San Gerardo Hospital, Monza	NA	Apgar $<$ 7 at 5 mins
Central and Eastern Europe, 8 studies (Bosnia and Herzegovina, Latvia, Moldova, Poland, Romania, and Slovakia)						
Marian-Pavlenco 2024	Moldova	Retrospective	01–2017 to 12–2017, 01–2019 to 12–2019, 01–2022 to 12–2022	All births at the Municipal Clinical Hospital in Chisinau	NA	NA
Racene 2023	Latvia	Cross-sectional	01–2019 to 12–2019	All births at the Riga Maternity Hospital	Suspected fetal compromise, dystocia, and other (planned CS performed urgently due to spontaneous labour, placental abruption, umbilical cord prolapse, others)	NA

(*continued on next page*)

Table 1 (*continued*)

First Author, Year	Country	Type of Study	Study duration	Population Characteristics	Reasons for Caesarean section	Reported Perinatal Outcomes
Węgrzynowska 2023	Poland	Cross-sectional	01–2010 to 12–2020	All births at the St. Sophia Specialist Hospital in Warsaw	NA	NA
Zahumensky 2023	Slovakia	Retrospective	01–2019 to 12–2020	Births at Comenius University and University Hospital in Bratislava	Fetal distress, breech Macrosomia, hypertensive diseases of pregnancy, others	Perinatal mortality, neonatal mortality, hypertensive diseases of pregnancy, neonatal intensive care unit admission
Matei 2021	Romania	Cross-sectional	03–2020 to 03–2021	Births from teen pregnancies	Fetal distress, failed induction of labour, other pregnancy complication	Hypertensive diseases of pregnancy, prolonged maternal hospital stay, neonatal intensive care unit admission, Apgar < 7 at 5 mins, other pregnancy complication
Zahumensky 2020	Slovakia	Retrospective cohort	01–2015 to 12–2018	Births at Comenius University and University Hospital in Bratislava	NA	Stillbirths, neonatal intensive care unit admission
Zahumensky 2019	Slovakia	Retrospective	01–2017 to 12–2017	Births at Comenius University, University Hospital in Bratislava and Dept of Obstetrics and Gynaecology, Trenčín	NA	Perinatal mortality, Apgar < 6 at 5 mins
Fatusic 2016	Bosnia and Herzegovina	Cross-sectional	01–2015 to 12–2015	Births at University hospital of Tuzla	NA	NA

Results

Study selection

There were 1385 studies identified by the literature search for screening (Fig. 1). Of these, 46 duplicates were removed, and 1339 studies were screened for the title/abstract out of which 1009 articles were considered illegible and were therefore excluded. The remaining 330 articles underwent full-text screening of which 46 studies met the inclusion criteria and were included in the final analysis (Fig. 1).

Study characteristics

Across the 25 European countries included in this review, a total of 12 505 939 births were analysed, with 8 543 803 (68.3 %) occurring in public hospitals and 3 962 136 (31.7 %) in private hospitals. The countries were categorised into one of the following European regions: Nordic, Western, Southern, Central-Eastern (Table 1). Nordic Europe included studies from Denmark, Finland, Iceland, Norway, and Sweden [14–20]. Western Europe from Austria, France, Germany, Ireland, Luxemburg, and Switzerland [15,21–28]. Central and Eastern Europe from Bosnia and Herzegovina, Latvia, Moldova, Poland, Romania, and Slovakia [29–36]. Southern Europe from Albania, Cyprus, Italy, Spain, and Turkey [6,37–58]. Nordic, Western, Central-Eastern Europe contributed only public hospital data.

Two studies performed multi-country analysis [14,15], and data was extracted at country level individually. The data was presented as separate studies in Table 1, and **Supplementary Information 4 and 5** resulting (70 original data sets). The largest number of studies were from Nordic Europe 20/70 (28.6 %), 14/70 (20 %) from Western Europe, 8/70 (11.4 %) from Central-Eastern Europe, and 28/70 (40 %) from Southern Europe.

In total, 7/70 (10 %) data sets were from private hospitals, all contributed by Southern Europe, more specifically from two different countries, Italy, and Turkey.

The largest study was a retrospective cohort, a national study of all births (5 915 825) in public and private hospitals in Turkey from 2018 to 2023 [56]. The smallest study was a cross-sectional study including 251 women from a public hospital in Romania [30]. Overall, 38/70 (54.3 %) were retrospective cohort studies (Table 1) and the study duration varied from 23 years in Marconi et al. [37] to 5 months in Shylla et al. [52].

Regional data

Among the four European regions, Southern Europe accounted for the largest population with a total of 8 880 527 (71 %) births out of 12 505 939, followed by Nordic Europe with 3 082 225 births (24.6 %), Western Europe with 978,499 births (7.8 %), and lastly Central-Eastern Europe with the least population with 106 413 births (0.9 %). The overall rate of CSs was highest in Southern Europe at 55.6 % followed by Western Europe at 30.9 %, Central-Eastern at 28 % and lastly, Nordic Europe at 16.9 % (Table 2).

For public hospitals, the CS rates were lowest in Nordic Europe (16.9 %, 520 298/3 082 225) with Robson Group 6 (Nulliparous women with a single breech pregnancy) accounting for the highest CS rate in the region at 88 % (52 059/59 154) (Table 2). The lowest CS rate in this region was observed in Robson group 3 (Multiparous women without a previous uterine scar, with a single cephalic pregnancy, ≥37 weeks' gestation in spontaneous labour) at a rate of 1.6 % (17 656/1 092 491). Moreover, the lowest CS rate for Robson group 1 (Nulliparous women with a single cephalic pregnancy, ≥37 weeks' gestation in spontaneous labour) in public hospitals was seen in this region at only 8 %.

The highest CS rates in public hospitals was observed for Southern Europe (41.3 %, 1 807 271/4 372 994) with Robson Group 5 (Multiparous women with at least one previous uterine scar, with a single cephalic pregnancy, ≥37 weeks' gestation) having the highest CS rate at 97.6 % (889 238/911 373) and Robson Group 3 the lowest (9.2 %). This region accounted even for the highest CS rates in Robson group 1 with a rate of 28.1 %.

In comparison, the highest CS rates in private hospitals were seen in Southern Europe with a rate of 73.7 % (2 918 225/3 962 136) where Robson group 5 accounted for the highest rate 98.1 % and Robson group 3 for the lowest 26.9 %. This region also accounted for the highest CS rates in Robson group 1 at 67.8 % (Table 2).

Robson group in public vs private hospitals

In public hospitals, the largest group by size was Group 3 (multiparous, term, singleton, cephalic, spontaneous labour), comprising 34.6 % of women (2 935 108/8 485 106), with a CS rate of only 5.8 % and contributing 6.5 % of all CS (Table 3). The largest contributor to the total CS rate was Group 5 (previous CS, term, singleton, cephalic), which represented 15.6 % of women (1 323 365/8 485 106) but accounted for 43.1 % of all CS (1 128 424/2 618 340), with a group-specific CS rate of

Table 2
Meta-analysis of included studies according to Robson group. Private hospital data published only from countries in Southern Europe. Study by Birinci et al. excluded (please see footnote).

Robson Group	Nordic Europe Total N (% contribution to total births) VB = n (%) CS = n (%)	Central-Eastern Europe Total N (% contribution to total births) VB = n (%) CS = n (%)	Western Europe Total N (% contribution to total births) VB = n (%) CS = n (%)	Southern Europe Total N (% contribution to total births) VB = n (%) CS = n (%)
Group 1 Nulliparous women with a single cephalic pregnancy, ≥37 weeks' gestation in spontaneous labour	N = 908219 (29.4) VB = 835294 (92) CS = 72925 (8)	N = 33251 (31.2) VB = 28213 (84.8) CS = 5038 (15.2)	N = 245747 (25.1) VB = 203559 (82.8) CS = 42188 (17.2)	**All hospitals** N = 2010487 (24.2) VB = 1033781 (51.4) CS = 977203 (48.6) **Public Private** N = 864905 (19.8) N = 1038021 (30) VB = 622405 (72) VB = 334177 (32.2) CS = 242997 (28) CS = 703844 (67.8)
Group 2 Nulliparous women with a single cephalic pregnancy, ≥37 weeks' gestation who either had labour induced or gave birth by CS before labour	N = 278502 (9) VB = 184801 (66.4) CS = 93701 (33.6)	N = 14239 (13.4) VB = 8060 (56.6) CS = 6179 (43.4)	N = 135610 (13.6) VB = 76887 (56.7) CS = 58723 (43.3)	**All hospitals** N = 475060 (5.7) VB = 219790 (46.3) CS = 255704 (53.8) **Public Private** N = 211871 (4.9) N = 191776 (5.5) VB = 128131 (60.5) VB = 62091 (32.4) CS = 84174 (39.7) CS = 129685 (67.6)
Group 3 Multiparous women without a previous uterine scar, with a single cephalic pregnancy, ≥37 weeks' gestation in spontaneous labour	N = 1092491 (35.4) VB = 1074835 (98.4) CS = 17656 (1.6)	N = 29989 (28.2) VB = 29177 (97.3) CS = 812 (2.7)	N = 247314 (25.3) VB = 238086 (96.3) CS = 9228 (3.7)	**All hospitals** N = 2215471 (26.6) VB = 1917787 (86.6) CS = 298098 (13.4) **Public Private** N = 1565314 (36.3) N = 528587 (15.3) VB = 1422439 (90.9) VB = 386457 (73.1) CS = 143289 (9.1) CS = 142130 (26.9)
Group 4 Multiparous women without a previous uterine scar, with a single cephalic pregnancy, ≥37 weeks' gestation who either had labour induced or gave birth by CS before labour	N = 249939 (8.1) VB = 204098 (81.7) CS = 45841 (18.3)	N = 6447 (6.1) VB = 5050 (78.3) CS = 1397 (21.7)	N = 96178 (9.8) VB = 76550 (79.6) CS = 19628 (20.4)	**All hospitals** N = 378433 (4.5) VB = 277201 (73.2) CS = 101386 (26.8) **Public Private** N = 207072 (4.8) N = 114068 (3.3) VB = 169939 (82) VB = 70751 (62) CS = 37287 (18) CS = 43317 (38)
Group 5 Multiparous women with at least one previous uterine scar, with a single cephalic pregnancy, ≥37 weeks' gestation	N = 271254 (8.8) VB = 132649 (48.9) CS = 138605 (51.1)	N = 12127* (11.4) VB = 2904 (23.9) CS = 9223 (76.1)	N = 128611 (13.1) VB = 37540 (29.2) CS = 91071 (70.8)	**All hospitals** N = 1920129 (23.1) VB = 46966 (2.4) CS = 1877232 (97.8) **Public Private** N = 911373 (21.2) N = 900926 (26) VB = 26204 (2.9) VB = 17490 (1.9) CS = 889238 (97.6) CS = 883436 (98.1)
Group 6 Nulliparous women with a single breech pregnancy	N = 59154 (1.9) VB = 7095 (11.9) CS = 52059 (88.1)	N = 2810 (2.6) VB = 129 (4.6) CS = 2681 (95.4)	N = 26250 (2.7) VB = 1849 (7) CS = 24401 (93)	**All hospitals** N = 205403 (2.5) VB = 10009 (4.8) CS = 195559 (95.2) **Public Private** N = 48222 (1.1) N = 137909 (3.9) VB = 3902 (8.1) VB = 3398 (2.5) CS = 44485 (92.3) CS = 134511 (97.5)
Group 7 Multiparous women with a single breech pregnancy, including women with	N = 37868 (1.2) VB = 7398 (19.5) CS = 30470 (80.5)	N = 1373 (1.3) VB = 205 (14.9) CS = 1168 (85.1)	N = 16558 (1.7) VB = 2208 (13.3) CS = 14350 (86.7)	**All hospitals** N = 185562 (2.2) VB = 11221 (6) CS = 174507 (94) **Public**

(continued on next page)

Table 2 (*continued*)

Robson Group	**Nordic Europe** Total N (% contribution to total births) VB = n (%) CS = n (%)	**Central-Eastern Europe** Total N (% contribution to total births) VB = n (%) CS = n (%)	**Western Europe** Total N (% contribution to total births) VB = n (%) CS = n (%)	**Southern Europe** Total N (% contribution to total births) VB = n (%) CS = n (%)
previous uterine scars				**Private** N = 61454 (1.4) N = 109642 (3.2) VB = 6170 (10) VB = 3310 (3) CS = 55450 (90) CS = 106332 (97)
Group 8				**All hospitals**
Women with multiple pregnancies, including women with previous uterine scars	N = 45842 (1.5) VB = 21933 (47.8) CS = 23909 (52.2)	N = 1474 (1.4) VB = 251 (17) CS = 1223 (83)	N = 20650 (2.1) VB = 5052 (24.5) CS = 15598 (75.5)	N = 213532 (2.6) VB = 17354 (8.1) CS = 196419 (91.9) **Public Private** N = 86615 (2) N = 115754 (3.3) VB = 12171 (14) VB = 4265 (3.7) CS = 74685 (86) CS = 111489 (96.3)
Group 9				**All hospitals**
Women with a single pregnancy with a transverse or oblique lie, including women with previous uterine scars	N = 10613 (0.3) VB = 3259 (30.7) CS = 7354 (69.3)	N = 352** (0.3) VB = 1 (0.3) CS = 351 (99.7)	N = 5682 (0.6) VB = 1062 (18.7) CS = 4620 (81.3)	N = 128035 (1.5) VB = 6224 (5) CS = 121637 (95) **Public Private** N = 33087 (0.8) N = 83933 (2.4) VB = 3531 (10.6) VB = 1834 (2.2) CS = 29582 (89.4) CS = 82099 (97.8)
Group 10				**All hospitals**
All women with a single cephalic pregnancy, <37 weeks' gestation, including women with previous uterine scars	N = 128343 (4.2) VB = 88018 (68.6) CS = 40325 (31.4)	N = 4351 (4.1) VB = 2516 (57.8) CS = 1835 (42.2)	N = 55899 (5.7) VB = 31738 (56.8) CS = 24155 (43.2)	N = 570248 (6.9) VB = 196666 (34.5) CS = 373898 (65.5) **Public Private** N = 305808 (7.1) N = 240720 (6.9) VB = 144074 (47.1) VB = 46938 (19.5) CS = 162050 (52.9) CS = 193782 (80.5)
ALL TOTAL	**N = 3082225 (25.8) VB = 2561927 (83.1) CS = 520298 (16.9)**	**N = 106413 (0.9) VB = 76506 (71.9) CS = 29907 (28.1)**	**N = 978499 (8.2) VB = 674537 (68.9) CS = 303962 (31.1)**	**N = 8321030 (69.7) VB = 3749283 (45.1) CS = 4571749 (54.9)**

CS: caesarean section; VB: vaginal birth.
In Nordic, Western, Central, and Eastern European regions, all data provided was exclusively from public hospitals.
Total Public: N = 4314297 (50.9), VB = 2551060 (59.1), CS = 1763237 (40.9).
Total Private: N = 3461336 (100), VB = 930711 (26.9), CS = 2530625 (73.1).
The study by Birinci et al. from private and public hospitals did not report total birth or the number of vaginal/caesarean births for each Robson group in the different hospitals and was therefore excluded from the *meta*-analysis.
* Data were extracted from percentages rather than absolute counts resulting in minor discrepancies within a margin of 0.1%.
**: The study by Fatusic did not report total births or the number of vaginal births, which prevented accurate calculation of overall figures; as a result, the study was excluded from the *meta*-analysis.

85.3 %. Other important contributors included Group 1 (nulliparous, term, singleton, cephalic, spontaneous labour) with 24.2 % of women (2 052 122/8 485 106) and a CS rate of 17.7 %, contributing 13.9 % of all CS, and Group 2 (induced or prelabour CS) with 7.6 % of women (640 222/8 485 106), a CS rate of 37.9 %, and 9.3 % of all CS.

In private hospitals, Group 1 was the largest group, representing 30.0 % of women (1 038 021/3 461 336), with a high CS rate of 67.8 %, contributing 27.8 % of all CS (703 844/2 530 625). Group 5 remained the single largest contributor, with 26.0 % of women (900 926/3 461 336) and a group-specific CS rate of 98.1 %, accounting for 35.0 % of all CS (883 436/2 530 625). Notably, other low-risk groups also demonstrated very high CS rates: Group 2 (induced or prelabour CS) accounted for 5.5 % of women (191 776/3 461 336), with a CS rate of 67.6 % and a relative contribution of 5.1 %; Group 3 included 15.3 % of women (528 587/3 461 336), with a CS rate of 26.9 % and a relative contribution of 5.6 %.

Overall, while Group 5 was the largest single contributor to CS in both public and private hospitals, the main difference was that in private hospitals, low-risk groups such as Groups 1 and 2 showed disproportionately high CS rates (67.8 % and 67.6 %, respectively), compared with much lower rates in public hospitals (17.7 % and 37.9 %, respectively).

Individual study level data

Ulgu et al. from Turkey [56] contributed with the largest national dataset of births in both public and private hospitals using the Robson classification system. The study reported the second highest CS rate in Europe, occurring in Turkey, with an overall rate of 57.6 % over a five-year period (2018–2023). A significant difference in mode of birth was observed based on the type of facility, with an increased risk of a CS when giving birth in a private hospital.

Amyx et al. [15] utilising data from the Euro-Peristat study was the largest regional study with data from 17 European countries, comparing the CS rate change between 2015 and 2019. In 2019 the lowest CS rates

Table 3
Robson Classification of all births in public vs private hospitals.

Robson Group	Number of CS in group	Number of women in group	Group size (%)*	Group CS rate (%)**	Absolute group contribution to overall CS rate (%)***	Relative group contribution to overall CS rate (%)****
Public Hospitals						
1	363 399	2 052 122	24.2	17.7	4.3	13.9
2	242 929	640 222	7.6	37.9	2.9	9.3
3	171 001	2 935 108	34.6	5.8	2.0	6.5
4	104 173	559 636	6.6	18.6	1.2	3.9
5	1 128 424	1 323 365	15.6	85.3	13.3	43.1
6	123 706	136 436	1.6	90.7	1.5	4.7
7	101 462	117 253	1.4	86.5	1.2	3.9
8	115 440	154 581	1.9	74.7	1.4	4.4
9	41 923	49 734	0.6	84.3	0.5	1.6
10	228 430	494 401	5.9	46.2	2.7	8.7
Total	2 618 340	8 485 106	100	–	–	100
Private Hospitals						
1	703 844	1 038 021	30.0	67.8	20.3	27.8
2	129 685	191 776	5.5	67.6	3.7	5.1
3	142 130	528 587	15.3	26.9	4.1	5.6
4	43 317	114 068	3.3	37.9	1.3	1.7
5	883 436	900 926	26.0	98.1	25.5	35.0
6	134 511	137 909	4.0	97.5	3.9	5.3
7	106 332	109 642	3.2	96.9	3.1	4.2
8	111 489	115 754	3.3	96.3	3.2	4.4
9	82 099	83 933	2.4	97.8	2.4	3.2
10	193 782	240 720	7.0	80.5	5.6	7.7
Total	2 530 625	3 461 336	100	–	–	100

Note: Study by Birinci et al. Was excluded from this table as no detailed numbers for the Robson groups were provided.
*Group size (%) = n of women in the group / total N women delivered in the hospital x 100.
**Group CS rate (%) = n of CS in the group / total N of women in the group x 100.
*** Absolute contribution (%) = n of CS in the group / total N of women delivered in the hospital x 100.
**** Relative contribution (%) = n of CS in the group / total N of CS in the hospital x 100.

were recorded in Norway at a rate of 16 %, whereas the highest rate the same year was observed in Cyprus at 52.2 %.

Risk of bias assessment

Table 4 presents the quality assessment of the studies included using the Newcastle-Ottawa Scale. 31/46 (67.4 %) of the studies scored a total of 3 out of 4 stars in the domain ‘selection’ with ‘representativeness of exposed cohort’ subdomain often lacking. A few studies 14/46 (30.4 %) scored 4/4 stars in selection (6, 14–16, 18–20, 22, 46–47, 49, 56–58). Regarding the domain ‘comparability’, almost half of the studies 22/46 (47.8 %) scored 2/2 stars mainly for comparing data for at least two different time-points. Finally, for the domain ‘outcomes’, 24/46 (52.2 %) studies scored 3/3 stars, as lengthy follow ups were less of interest for this review, mainly focusing on birth data.

Discussion

We conducted an extensive systematic review and *meta*-analysis investigating CS rates in public and private institutions across Europe according to the Robson group classification system. Our analysis of 46 studies revealed high CS rates across Europe, with Southern Europe reporting the highest levels. Rates were consistently higher in private compared to public hospitals, with an overall CS rate of 73.1 % in private hospitals versus 30.9 % in public hospitals. In both settings, Group 5 (women with a previous CS) was the largest contributor to the overall CS rate, accounting for 43.1 % of CS in public hospitals and 35.0 % in private hospitals. However, a key difference was seen in low-risk women: in private hospitals, Groups 1 and 2 (nulliparous, term, singleton, cephalic pregnancies in spontaneous or induced labour/prelabour CS) had strikingly high CS rates of 67.8 % and 67.6 %, compared with 17.7 % and 37.9 % in public hospitals. These findings highlight that the excess CS burden in private hospitals is largely driven by unnecessary procedures in low-risk groups.

In line with earlier research, our data confirm the increasing trend in CS rates and the wide variation in CS rates across European regions, ranging from 16.9 % to 55.6 % [59]. This is consistent with the findings of Macfarlane et al., who, using 2010 data from the Euro-Peristat project, reported regional differences between Western and Southern Europe ranging from 14.8 % to 52.2 % [60].

Several studies from Southern Europe report similar findings with rising CS rates particularly within the private healthcare sector. In Greece, CS rates reached 53 % in private hospitals compared to 41.6 % in public ones [61]. A study from Italy by Strambi et al. analysing the CS rates between 2012–2017 confirmed an upward CS trend in private hospitals reaching 59.2 % [40]. In Turkey, higher rates were reported in 2017, with a national rate of 70.6 % [6]. A common finding among all studies conducted in private hospitals was the substantial contribution of Group 1 and Group 5 to the overall CS rate, indicating variations in the medical practice culture, guidelines, maternal preference, and possibly incentives motivating physicians to perform CS. The large contribution of Group 5 to the overall CS rate was even observed in public institutions, indicating how previous CS can predict the medical decisions for future births. High CS rates in Group 1 therefore act as the engine of a self-perpetuating cycle, steadily fuelling the overall rise in CS. Breaking this cycle depends on one crucial strategy: hindering the first caesarean.

Globally, a study by Boerma et al. with data from 169 countries, revealed a CS rate of 21 % in 2015, with strong evidence of CS overuse in private hospitals and among wealthier women [62]. These global rates were reaffirmed by Betran et al. [63]. In Brazil, a study from 2024 showed similar findings with higher CS rates in the private sector [64]. In line with our earlier findings, CSs in Group 1 constituted a large proportion of the overall rate, illustrating the global concern regarding the overuse of CS in low-risk groups. Several countries from different regions reported similar finding. For instance, studies conducted in Iran

Table 4
Risk of bias assessment using the Newcastle-Ottawa Scale.

Study	Selection				Comparability	Outcomes			Total
	Representativeness of exposed cohort	Selection of nonexposed cohort	Ascertainment of exposure	Outcome not present at the start of the study		Assessment of outcomes	Length of follow-up	Adequacy of follow-up	
Gantt 2024	–	*	*	*	**	*	*	*	8
Shylla 2024	–	*	*	*	–	*	*	*	6
Marian-Pavlenco 2024	–	*	*	*	**	*	*	*	8
Abuduxike 2024	–	*	*	*	–	*	*	*	6
Kinci 2024	–	*	*	*	**	*	*	*	8
Amyx 2023	*	*	*	*	**	*	*	*	9
Racene 2023	–	*	*	*	–	*	*	*	6
Węgrzynowska 2023	–	*	*	*	**	*	*	*	8
Gutiérrez-Martínez 2023	–	*	*	*	–	*	*	*	6
Ulgu 2023	*	*	*	*	*	*	*	*	8
Sanisoglu 2023	*	*	*	*	–	*	*	*	7
Birinci 2023	*	*	*	*	**	*	*	*	9
Golbasi 2023	–	*	*	*	–-	*	*	*	6
Keskin 2023	*	*	*	*	**	*	–	–	7
Laine 2023	*	*	*	*	**	*	*	–	7
Zahumensky 2023	–	*	*	*	**	*	*	*	8
Bulut 2022	–	*	*	*	**	*	–	–	6
Marconi 2022	–	*	*	*	*	–	–	–	4
diPasquo 2022	–	*	*	*	**	*	*	–	7
Muraca 2022	*	*	*	*	*	*	*	*	8
Savchenko 2022	*	*	*	*	–-	*	*	*	7
Sirico 2022	–	*	*	*	**	*	*	*	8
Eftekharian 2021	–	*	*	*	*	*	*	–	6
Eyi 2021	*	*	*	*	–-	*	–	–	5
Matei 2021	–	*	*	*	–-	*	*	*	6
Palacios-Marques 2021	–	*	*	*	**	*	*	*	8
Pulvermacher 2021	*	*	*	*	**	–	–	–	6
Topçu 2021	–	*	*	*	–-	*	–	–	4
Valladolid 2021	*	*	*	*	–-	*	–	–	5
Zeitlin 2021	*	*	*	*	*	*	–	–	6
Bracic 2020	–	*	*	*	**	*	–	–	6
Crequit 2020	–	*	*	*	*	*	*	*	7
Denona 2020	–	*	–	*	*	–	–	–	3
Pinto 2020	–	*	*	*	**	*	*	*	8
Strambi 2020	–	*	*	*	–-	*	–	–	4
Vila-Candel 2020	*	*	*	*	–-	*	–	–	5
Zahumensky 2020	–	*	*	*	**	*	*	*	8
Einarsdóttir 2019	*	*	*	*	–-	*	*	–	6
Kempe 2019	–	*	*	*	–-	*	*	*	6
Zahumensky 2019	–	*	*	*	–-	*	*	*	6
Triunfo 2018	–	*	*	*	**	*	–	–	6
Fatusic 2016	–	*	*	*	–-	*	–	–	4
Jayot 2016	–	*	*	*	**	*	–	–	6
Triunfo 2015	–	*	*	*	**	*	–	–	6
Mueller 2014	–	*	*	*	**	*	–	–	6
Ciriello 2012	–	*	*	*	**	*	*	–	7

Comparability:
*Studies that have been adjusted for any reason such as BMI, induction of labour maternal age, neonatal- and maternal outcome.
** Studies that have compared two different timepoints.

and Ethiopia revealed notable disparities in CS rates between public and private hospitals with higher rates at the latter [65,66].

It is evident that there is an overuse of surgical births, especially within the private healthcare sector, and this trend is going upwards. CS without medical indication puts the life of the mother and the newborn at unnecessary risk. Moreover, medically unjustified CSs burden the healthcare system with avoidable costs. It was reported by Birinci et al. that CSs costed nearly 1 billion 750 million Turkish liras in 2022 [58]. The high contribution of Group 1 to the overall CS rates in the private and public system is worrying. However, it indicates the potential for intervention and the implementation of strategies to revert this upgoing trend. For example, educating physicians, offering evidence-based counselling and support systems for patients as recommended by EBCOG [67], and establishing clear guidelines for healthcare professionals are some of many strategies that can be employed to tackle this problem.

An additional aspect that is oft overlooked was pointed out in the 2025 study by Wladimiroff et al [68]. When noting significant variations in European countries caesarean rates, particularly the prevalence of repeat CS, concerns were about the future training of specialist doctors due to reduced exposure to complex vaginal births, with the knock-on effect of impacting the quality of specialist training in obstetrics [68].

To the best of our knowledge, this is the largest systematic review and *meta*-analysis using the Robson group classification system and comparing CS rates between public and private institutions in Europe. With studies included from 25 countries, a total of more than 12 million births included over the 25 years study period, our review presents a comprehensive analysis of CS rates across Europe providing a robust foundation for future research and policy development in maternal healthcare. Among the strengths of our review are the inclusion of different study designs, large population sizes, studies from 25 different European countries, the use of the same classification system in all studies included, and good representation from the regions included.

The limitations of our study include limited data from private hospitals which were represented exclusively by studies from the Southern European region. Consequently, underscoring the importance of reporting and publishing more data from private institutions. In addition, very few studies reported the reasons for CS limiting the possibility to distinguish the influence of medical and non-medical factors on the choice of the mode of birth. Although data presenting perinatal outcomes were collected from many studies, they were not analysed as they fell outside the primary objective of the review and therefore did not contribute to the study's conclusion. We included a study by Birinci et al. reporting the total numbers of births in public and private hospitals in Turkey, however, the study did not report detailed numbers for each Robson group, thus affecting the total numbers [58]. Similarly, a study by Quibel et al. from France lacked detailed numbers for the Robson groups which resulted in excluding the study, therefore, all data from private hospital came from only one European region [69]. Our review included studies from the past 25 years which might not directly reflect the current medical practice and increase the risk for bias. Moreover, the studies exhibited inherent heterogeneity with notable variations in risk of bias assessments. Finally, for some studies, minor discrepancies were noted between the reported totals and the manually calculated values which may have impacted the overall reliability of the findings [22,26,32,33,38,39,44,45].

National policy advisors should act on these findings by prioritising interventions that reduce unnecessary caesareans, particularly in private hospitals where we found that the rates were disproportionately high among low-risk women. Policies should focus on strengthening the implementation of evidence-based clinical guidelines, improving physician training and accountability, and ensuring consistent use of the Robson classification system to monitor practice. Advisors should also encourage greater transparency and reporting from private institutions, while incentivising vaginal births were medically safe. Public awareness campaigns and structured counselling for expectant mothers can also help reduce maternal demand for planned CS without indication. By targeting efforts to reduce "first caesareans" in low-risk groups, policies can break the cycle of repeat CS, thereby easing the growing financial and clinical burden on healthcare systems, while safeguarding maternal and newborn health.

Conclusion

This systematic review and *meta*-analysis of more than 12 million births across 25 European countries demonstrates that CS rates remain high, with substantial regional variation and consistently higher rates in private compared to public hospitals (73.1 % vs. 30.9 %). While Group 5 (women with a previous CS) was the largest contributor to overall CS rates in both sectors, the most striking difference lay in low-risk groups: in private hospitals, nulliparous women with term, singleton, cephalic pregnancies in spontaneous or induced labour (Groups 1 and 2) had disproportionately high CS rates of nearly 68 %, compared with 18–38 % in public institutions. These findings highlight how private-sector practices are accelerating the overuse of CS, particularly in low-risk women, and how high CS rates in Group 1 drive a self-perpetuating cycle of repeat procedures.

Our results confirm earlier evidence from Europe and align with global patterns, underscoring that non-medically indicated CS is a pressing concern with implications for maternal and newborn outcomes as well as healthcare costs. Strategies such as strengthening clinical guidelines, physician education, and patient counselling as recommended by professional bodies including EBCOG, are urgently needed to curb unnecessary CS and to prioritise safe, evidence-based care. By adopting policies that prevent the first caesarean, health systems have an opportunity to reverse the rising trend and reduce the long-term burden of non-essential surgical births.

CRediT authorship contribution statement

Sara Ebadi: Writing – original draft, Formal analysis. **Viktoria El Radaf:** Data curation, Conceptualization. **Tahir Mahmood:** Writing – review & editing. **Charles Savona-Ventura:** Writing – review & editing. **Mehreen Zaigham:** Writing – review & editing, Supervision, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This paper was supported by the European Board and College of Obstetrics and Gynaecology (EBCOG).

The author would like to thank our librarian at Lund University, Krister Aronsson, and Letícia Nunes Campos from the faculty of medicine in Recife, Brazil for their help with the literature search strategy and execution.

Funding

This study was funded by the Swedish Governmental ALF Grant for Clinical Research (YF00033, MZ), and the Sweden-America Foundation.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ejogrb.2025.114921.

Data availability

Additional data is available in Supplementary material. Raw data is available upon reasonable request.

References

[1] Yang J. C-section rates by country OECD, Statista, 2025. Available at: https://www.statista.com/statistics/283123/cesarean-sections-in-oecd-countries/ (Accessed: 21 December 2025).

[2] Sandall J, Tribe RM, Avery L, Mola G, Visser GH, Homer CS, et al. Short-term and long-term effects of caesarean section on the health of women and children. Lancet 2018;392(10155):1349–57.

[3] Słabuszewska-Jóźwiak A, Szymański JK, Ciebiera M, Sarecka-Hujar B, Jakiel G. Pediatrics consequences of caesarean section-a systematic review and meta-analysis. Int J Environ Res Public Health 2020;17(21):8031.

[4] World Health Organization. Caesarean section rates continue to rise, amid growing inequalities in access, 2021. [online] www.who.int. Available at: https://www.who.int/news/item/16-06-2021-caesarean-section-rates-continue-to-rise-amid-growing-inequalities-in-access.

[5] Montagu D. The provision of private healthcare services in European countries: recent data and lessons for universal health coverage in other settings. Front Public Health 2021;15(9):636750. https://doi.org/10.3389/fpubh.2021.636750. PMID: 33791271; PMCID: PMC8005513.
[6] Eyi EGY, Mollamahmutoglu L. An analysis of the high cesarean section rates in Turkey by Robson classification. J Matern Fetal Neonatal Med 2021;34(16):2682–92.
[7] Robson Classification: Implementation Manual. [Internet]. WHO. Published 26 November 2017. Accessed 21 December 2025. Available at: https://www.who.int/publications/i/item/9789241513197.
[8] Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Ann Intern Med 2009;151(4):264–9. W264.
[9] Covidence systematic review software, Veritas Health Innovation, Melbourne, Australia. Available at www.covidence.org.
[10] World Atlas. [Internet]. Accessed 21 December 2025. Available at: https://www.worldatlas.com/articles/the-four-european-regions-as-defined-by-the-united-nations-geoscheme-for-europe.html.
[11] Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. Eur J Epidemiol 2010;25(9):603–5.
[12] Barendregt; JJ, Doi SA, Lee YY, Norman RE, Vos T. Meta-analysis of prevalence. J Epidemiol Community Health 2013;67(11):974–8.
[13] Higgins JPT, Thomas J, Chandler J, editors. Cochrane Handbook for Systematic Reviews of Interventions. 2nd ed. Chichester: Wiley; 2019.
[14] Zeitlin J, Durox M, Macfarlane A, Alexander S, Heller G, Loghi M, et al. Using Robson's ten-group classification system for comparing caesarean section rates in europe: an analysis of routine data from the Euro-Peristat study. BJOG 2021;128(9):1444–53.
[15] Amyx M, Philibert M, Farr A, Donati S, Smárason AK, Tica V, et al. Trends in caesarean section rates in Europe from 2015 to 2019 using Robson's Ten Group Classification System: A Euro-Peristat study. BJOG. 2024 Mar;131(4):444-454.
[16] Einarsdóttir K, Sigurðardóttir H, Ingibjörg Bjarnadóttir R, Steingrímsdóttir Þ, Smárason AK. The Robson 10-group classification in Iceland: obstetric interventions and outcomes. Birth 2019;46(2):270–8.
[17] Kempe P, Vikström-Bolin M. The continuous audit of events and outcomes of labour and birth using the ten Group Classification System and its role in quality improvement. Eur J Obstet Gynecol Reprod Biol 2019;237:181–8.
[18] Laine K, Pay AD, Yli BM. Time trends in caesarean section rates and associations with perinatal and neonatal health: a population-based cohort study of 1 153 789 births in Norway. BMJ Open 2023;13(2):e069562.
[19] Muraca GM, Joseph KS, Razaz N, Ladfors LV, Lisonkova S, Stephansson O. Crude and adjusted comparisons of cesarean delivery rates using the Robson classification: a population-based cohort study in Canada and Sweden, 2004 to 2016. PLoS Med 2022;19(8):e1004077.
[20] Savchenko J, Ladfors L, Hjertberg L, Hildebrand E, Brismar WS. A step towards better audit: the Robson ten Group classification system for outcomes other than cesarean section. Acta Obstet Gynecol Scand 2022 Jul;101(7):827–35.
[21] Eftekharian C, Husslein PW, Lehner R. Cesarean section rate and perinatal outcome analyses according to Robson's 10-group classification system. Matern Child Health J 2021;25(9):1474–81.
[22] Pulvermacher C, Van de Vondel P, Gerzen L, Gembruch U, Welchowski T, Schmid M, et al. Analysis of cesarean section rates in two German hospitals applying the 10-Group Classification System. J Perinat Med 2021;49(7):818–29.
[23] Bracic T, Pfniß I, Taumberger N, Kutllovci-Hasani K, Ulrich D, Schöll W, et al. A 10 year comparative study of caesarean deliveries using the Robson 10 group classification system in a university hospital in Austria. PLoS One 2020;15(10):e0240475.
[24] Crequit S, Korb D, Morin C, Schmitz T, Sibony O. Use of the Robson classification to understand the increased risk of cesarean section in case of maternal obesity. BMC Pregnancy Childbirth 2020;20(1):738.
[25] Denona B, Foley M, Mahony R, Robson M. Discrimination by parity is a prerequisite for assessing induction of labour outcome - cross-sectional study. BMC Pregnancy Childbirth 2020;20(1):709.
[26] Jayot A, Nizard J. Evolution of cesarean categories in a modified Robson classification in a single center from 2002 to 2012 due to high rate of maternal pathology. J Obstet Gynaecol Res 2016;42(6):648–54.
[27] Mueller M, Kolly L, Bauman M, Imboden S, Surbek D. Analysis of caesarean section rates over time in a single Swiss centre using a ten-group classification system. Swiss Med Wkly 2014;19(144):w13921.
[28] Gantt DM, Misselwitz B, Boos V, Reitter A. Errors in the classification of pregnant women according to Robson ten-group classification system. Eur J Obstet Gynecol Reprod Biol 2024;295:53–7.
[29] Fatusic J, Hudic I, Fatusic Z, Zildzic-Moralic A, Zivkovic M. Cesarean section rate analysis in University Hospital Tuzla - according to Robson's classification. Med Arch 2016;70(3):213–6.
[30] Matei A, Dimitriu MC, Roşu GA, Furău CG, Ionescu CA. Investigating caesarean section practice among teenage romanian mothers using modified Robson ten group classification system. Int J Environ Res Public Health 2021;18(20):10727.
[31] Zahumensky J, Psenkova P, Nemethova B, Halasova D, Kascak P, Korbel M. Evaluation of cesarean delivery rates at three university hospital labor units using the Robson classification system. Int J Gynaecol Obstet 2019;146(1):118–25.
[32] Zahumensky J, Psenkova P, Dolezal P, Otapkova P, Papcun P, Ferianec V, et al. Impact of implementing a multifaceted intervention to reduce rates of cesarean section: a quality-improvement study. Int J Gynaecol Obstet 2020;151(2):244–8.
[33] Zahumensky J, Psenkova P, Ostatnikova M, Chvalna Z, Dominova N, Jurcisinova M. The effect of anti-pandemic measures on some aspects of obstetric care in a single obstetric unit in the Slovak Republic. Ginekol Pol 2023;94(6):476–83.
[34] Marian-Pavlenco A, Siritanu I, Ribac T, Friptu V. Cesarean delivery in a tertiary institution of the Republic of Moldova: analysis using the Robson classification. AJOG Glob Rep 2024;4(4):100408.
[35] Racene L, Rostoka Z, Kise L, Kacerauskiene J, Rezeberga D. In-Depth analysis of caesarean section rate in the largest secondary care-level maternity hospital in Latvia. J Clin Med 2023;12(19):6426.
[36] Węgrzynowska M, Baranowska B, Sys D, Kajdy A, Karzel K, Bączek G, et al. Using Robson classification to analyze cesarean section and induction rates in relation to changes in the standards of perinatal care in one hospital in Poland. Birth 2024;51(2):384–94.
[37] Marconi AM, Manodoro S, Cipriani S, Parazzini F. Cesarean section rate is a matter of maternal age or parity? J Matern Fetal Neonatal Med 2022;35(15):2972–5.
[38] di Pasquo E, Ricciardi P, Valenti A, Fieni S, Ghi T, Frusca T. Achieving an appropriate cesarean birth (CB) rate and analyzing the changes using the Robson Ten-Group Classification System (TGCS): Lessons from a Tertiary Care Hospital in Italy. Birth 2022;49(3):430–9.
[39] Sirico A, Carbone L, Avino L, Buonfantino C, De Angelis MC, Cresce MD, et al. Trends in caesarean section rate according to Robson group classification among pregnant women with SARS-CoV-2 infection: a single-center large cohort study in Italy. J Clin Med 2022;11(21):6503.
[40] Strambi N, Sorbi F, Bartolini GM, Forconi C, Sisti G, Seravalli V, et al. Non-clinical variables influencing cesarean section rate according to Robson classification. Medicina (Kaunas) 2020;56(4):180.
[41] Triunfo S, Ferrazzani S, Draisci G, Zanfini BA, Scambia G, Lanzone A. Role of maternal characteristics and epidural analgesia on caesarean section rate in groups 1 and 3 according to Robson's classification: a cohort study in an Italian university hospital setting. BMJ Open 2018;8(4):e020011.
[42] Triunfo S, Ferrazzani S, Lanzone A, Scambia G. Identification of obstetric targets for reducing cesarean section rate using the Robson ten group classification in a tertiary level hospital. Eur J Obstet Gynecol Reprod Biol 2015;189:91–5.
[43] Ciriello E, Locatelli A, Incerti M, Ghidini A, Andreani M, Plevani C, et al. Comparative analysis of cesarean delivery rates over a 10-year period in a single Institution using 10-class classification. J Matern Fetal Neonatal Med 2012;25(12):2717–20.
[44] Palacios-Marques AM, Quijada-Cazorla MA, Marcos-Sanmartin J, Garcia-Villalba A, Perez-Silvestre L, Jimenez-Martinez MD, et al. Rationalisation of the caesarean section rate in a tertiary referral hospital using the Robson classification. J Obstet Gynaecol 2021;41(2):200–6.
[45] Pinto P, Crispín-Milart PH, Rojo E, Adiego B. Impact of clinical audits on cesarean section rate in a Spanish hospital: analysis of 6 year data according to the Robson classification. Eur J Obstet Gynecol Reprod Biol 2020;254:308–14.
[46] Valladolid A, Fraca M, Román MVS, Bilbao A, Andia D. Use of the Robson classification system to assess cesarean delivery rate in a tertiary hospital in the Basque Country. J Obstet Gynaecol Can 2021;43(4):455–62.
[47] Vila-Candel R, Martín A, Escuriet R, Castro-Sánchez E, Soriano-Vidal FJ. Analysis of caesarean section rates using the robson classification system at a university hospital in Spain. Int J Environ Res Public Health 2020;17(5):1575.
[48] Golbasi C, Golbasi H, Bayraktar B, Omeroglu I, Vural T, Sahingoz Yildirim AG, et al. Cesarean delivery rates based on time and indication using the Robson ten-group classification system: assessment at a Turkish tertiary center. J Obstet Gynaecol Res 2023;49(3):883–92.
[49] Keskin S, Keskin DD, Bostan S. An evaluation of cesarean delivery rates according to robson classification in the Black Sea Region of Turkey. J Coll Physicians Surg Pak 2023;33(1):92–6.
[50] Bulut AN, Ceyhan V. Cesarean rate and indications at a tertiary center. Erciyes Med J 2022;44(1):39–43.
[51] Topçu HO, Özel Ş, Üstün Y. Identifying strategies to reduce cesarean section rates by using Robson ten-group classification. J Matern-Fetal Neonatal Med 2019;34(16):2616–22.
[52] Shylla A, Teferici D, Shpuza A, Xhetani X, Roshi E. Factors affecting elective and non-elective cesarean sections: a multinomial regression analysis using Robson's classification in a southeast European Country. Cureus 2024;16(6):e62038.
[53] Abuduxike G, Cali S, Vaizoğlu SA, Aşut Ö, Çavuş M, Olgu M, et al. An analysis of the mode of delivery, risk factors, and subgroups with high caesarean birth rates using Robson classification system. Matern Child Health J 2024;28(4):667–78.
[54] Gutiérrez-Martínez S, Fernández-Martínez MN, Adánez-García JM, Fernández-Fernández C, Pérez-Prieto B, García-Gallego A, et al. Applying the modified ten-group robson classification in a Spanish tertiary hospital. J Clin Med 2023;13(1):252.
[55] Kinci MF, Kasap B, Akin MN, Selimoğlu B, Taştan L, Akin Gökbel D, et al. Analysis of cesarean section ratios by Robson classification. J Obstet Gynaecol India 2024;74(5):434–9.
[56] Ulgu MM, Birinci S, Altun Ensari T, Gözükara MG. Cesarean section rates in Turkey 2018-2023: overview of national data by using Robson ten group classification system. Turk J Obstet Gynecol 2023;20(3):191–8.
[57] Sanisoglu S, Engin-Ustun Y, Karatas Baran G, Kurumoglu N, Keskinkilic B. Use of ten-group Robson classification in Türkiye to discuss cesarean section trends. Minerva Obstet Gynecol 2023;75(4):333–9.
[58] Birinci Ş, Parpucu ÜM. When a caesarean section is necessary: analysis of cesarean sections performed in the Republic of Turkey in 2022 in accordance with the World Health Organization multi-country research guidelines. Turk J Obstet Gynecol 2023;20(3):184–90.

[59] El Radaf V, Campos LN, Savona-Ventura C, Mahmood T, Zaigham M. Robson ten group classification system for Caesarean sections across Europe: a systematic review and meta-analysis. Eur J Obstet Gynecol Reprod Biol 2025;305:178–98.

[60] Macfarlane AJ, Blondel B, Mohangoo AD, Cuttini M, Nijhuis J, Novak Z, et al. Wide differences in mode of delivery within Europe: risk-stratified analyses of aggregated routine data from the Euro-Peristat study. BJOG 2016;123(4):559–68.

[61] 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(3):288–95.

[62] Boerma T, Ronsmans C, Melesse DY, Barros AJD, Barros FC, Juan L, et al. Global epidemiology of use of and disparities in caesarean sections. Lancet 2018;392(10155):1341–8.

[63] Betran AP, Ye J, Moller AB, Souza JP, Zhang J. Trends and projections of caesarean section rates: global and regional estimates. BMJ Glob Health 2021;6(6):e005671.

[64] Pereira VB, Reis SND, Araújo FG, Amorim T, Martins EF, Felisbino-Mendes MS. Trends in cesarean section rates in Brazil by Robson classification group, 2014-2020. Rev Bras Enferm 2024;77(3):e20230099.

[65] Pourshirazi M, Heidarzadeh M, Taheri M, Esmaily H, Babaey F, Talkhi N, et al. Cesarean delivery in Iran: a population-based analysis using the Robson classification system. BMC Pregnancy Childbirth 2022;22(1):185.

[66] Geze S, Tura AK, Fage SG, van den Akker T. Can the Robson 10 group classification system help identify which groups of women are driving the high caesarean section rate in major private hospitals in eastern Ethiopia? A cross-sectional study. BMJ Open 2021;11(8):e047206.

[67] EURO-PERISTAT Project. European perinatal health report. Paris: EURO-PERISTAT; 2008. Available from: http://www.europeristat.com/reports/european-perinatal-health-report2004.html.

[68] Wladimiroff J, Tsiapakidou S, Mahmood T, Velebil P. Caesarean section rates across Europe and its impact on specialist training in Obstetrics: a qualitative review by the standing Committee of Hospital Visiting Programme for Training Recognition of the European Board and College of the Obstetrics and Gynaecology (EBCOG). Eur J Obstet Gynecol Reprod Biol 2025;304:77–83.

[69] Quibel T, Rozenberg P, Bouyer C, Bouyer J. Variation between hospital caesarean delivery rates when Robson's classification is considered: an observational study from a French perinatal network. PLoS One 2021;16(8):e0251141.