

Research

Patterns of cesarean birth rates in the public and private hospitals of Romania

Iulia Slovenski¹  · Nadya Wells^{1,2}  · David Evans¹ 

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Abstract

Caesarean sections (CSs) are essential surgical procedures that can save lives during childbirth, but can also pose health risks for mothers and infants. However, CS rates continue to rise globally beyond recommended values. This study provides a national and regional analysis of CS rates in Romania in 2020 across public and private hospitals, probing the influence of financial incentives on CS overuse, under the Romanian Diagnosis-Related Group (Ro-DRG) payment system. Ro-DRG data was aggregated from all 191 Romanian hospitals (171 public, 20 private) that reported deliveries in 2020, and described using quantitative methods. For each hospital, the Ro-DRG data included the total number of deliveries, the distribution across relevant Ro-DRG codes, and the average length of hospital stay. In 2020, 149,466 childbirth cases were reported through the Ro-DRG system; 89% in public and 11% in private hospitals. The national CS rate was 52.9%, with public hospitals reporting a rate of 49.7% compared to 79.8% in private hospitals. Regionally, CS incidence ranged from 29.89 to 71.42%. The Ro-DRG analysis revealed a high prevalence of high-complexity codes for both CS and natural deliveries, associated with higher payments. Additionally, the average length of hospital stay for CSs was longer in public (5.24 days) than in private hospitals (3.31 days), raising questions about hospital practices and resource utilization. The study suggests that financial incentives might be a contributing factor increasing Romanian CS rates. Targeted policy interventions are essential for aligning financial incentives with clinical necessity and ensuring the efficient use of healthcare resources.

1 Background

A caesarean section (CS) is a potentially life-saving surgical procedure that can reduce complications during childbirth [1]. However, there is evidence of highly associated health risks for both mother and child if the procedure is performed for non-medical reasons [2–6]. Nonetheless, the incidence of childbirth through CS deliveries continues to rise worldwide, especially in middle- and high-income countries, sparking concerns about public health outcomes [4, 7–11]. In Romania, the latest official data reported 40.1% of births by CS in 2013 [12], considerably surpassing the World Health Organization (WHO)-recommended CS rate of 10–15% (5,13). A 2018 study estimated Romania's CS rate to be 46.9%—the highest in Europe [8]. This cross-sectional study provides an updated analysis of CS rates in Romania in 2020 measured through

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✉ Iulia Slovenski, iulia.slovenski@graduateinstitute.ch | ¹Graduate Institute of International and Development Studies, Chem. Eugène-Rigot 2, 1202 Geneva, Switzerland. ²Faculty of Medicine, University of Geneva, Geneva, Switzerland.



the Romanian Diagnosis-Related-Groups (Ro-DRG) payment system, contrasting regional practices and incentives across public and private hospitals.

In 1985, WHO experts agreed that CS procedures should be accessible, but not exceed 10–15%, given typical obstetric indications and comparative benefits associated with vaginal deliveries (VD) [5, 13]. Nonetheless, CS use has continued to increase in most countries. Betrán et al. estimated that the global average CS rate rose from 6.7% in 1990 to 21.1% in 2018, projected to reach 28.5% by 2030 [7, 8]. Regionally, the highest CS rates are found in Latin American and Caribbean countries (42.8%), and the lowest are found in sub-Saharan African countries (5%). In Europe, the same study estimated an average 25.7% CS rate [8]. Within countries, CS rates tend to increase with economic status, with poorer subgroups recording significantly lower rates (often below the WHO recommended rates, suggesting underuse) than the wealthiest subgroups (above the recommended rates, suggesting overuse) [9, 14]. Moreover, the use of CSs is calculated to be approximately 1.5 times more frequent in private, for-profit facilities than in not-for-profit, public institutions [14, 15].

Several factors outside of medical indications (e.g. fetal stress or failure to progress) influence the evolution of CS incidence, the most frequently mentioned being maternal request [16–20]. Other factors include: expanded access to in-hospital births caused by urbanization, obstetricians' fear of malpractice litigation, insurance coverage incentives for mothers, and financial incentives for medical service providers who favor caesarian deliveries [10, 14, 16, 21]. Compared to vaginal childbirth, CS yields higher revenues for hospitals and doctors in most healthcare systems [10, 15, 22]. The financial incentives for providers favoring CSs have also been used to explain the higher incidence of CSs in for-profit, than in not-for-profit hospitals [15, 23].

In Romania, CS incidence has risen rapidly in recent decades and reached its highest level in Europe, surpassing 40% in 2013 [8, 12]. Consistent with results in other settings, the main drivers of this trend in Romania have been identified as maternal demand, and the substantial financial incentives for health service providers to perform CSs, both in public and especially in private facilities [24, 25]. In the public sector, the childbirth procedures (VD or CS) are covered by the state budget, which reimburses the hospital for providing medical services [24]. Ro-DRGs have been widely adopted as a reimbursement system in Romania's public hospitals. These provide a lump sum payment per episode of care, accounting for the complexity of the case attributed to the Ro-DRG. As a surgical procedure with greater complexity and associated risks, CSs are better paid than VDs through the Ro-DRG payment system [24, 26–28]. In the private sector, the out-of-pocket (OOP) cost for a CS is estimated to surpass EUR 2000, from which obstetricians receive a fixed percentage of the revenue [24].

The high and growing CS rates in Romania have been often linked to financial incentives for providers, albeit without substantial evidence [24, 25, 29]. To support this statement, the higher incidence of CSs in the private sector has been speculated to exceed 60%, but no factual evidence supports these estimations [29]. We seek to fill this gap through a cross-sectional study of CS rates in public and private Romanian hospitals in 2020, as reflected by a quantitative analysis of Ro-DRG codes used to classify childbirth cases. To frame and complement this analysis, we provide an overview of the Romanian hospital payment system, and highlight the indicators suggesting that financial incentives are a potentially influential factor of CS rates (e.g. average length of hospital stay). Finally, this study updates and expands previous analyses of CS rates in Romania, providing recent figures for both public and private facilities in 2020 across 41 districts and the Romanian capital of Bucharest.

2 Methodology

This study employs a quantitative research design to describe Romanian CS rates in public and private inpatient facilities, as illustrated by the recorded Ro-DRG codes for childbirth cases.

First, a scoping literature review was conducted through desk research in English and Romanian languages to frame Romanian CS rates in regional and global context, describe the Ro-DRG payment system, and determine how Ro-DRGs are used for reimbursement of childbirth cases. Then, we identified and scanned the Center of Human Resources, Evaluation and Analysis of Health Services of Romania (INMSS) online platform as a relevant and official source of aggregated Ro-DRG data [26]. At the time of the study, the most recent available Ro-DRG data across all Romanian districts were collected in 2020, which was selected as the reference period under analysis.

For the year 2020, a total of 713 inpatient facilities were registered on the INMSS platform across 41 regional districts and the capital, Bucharest. These included 462 public and 251 private hospitals. However, only 465 (65.2%) of these establishments had uploaded and made their Ro-DRG records available on the platform, and only 191/465 (41%) had reported childbirth cases, and therefore used childbirth-related Ro-DRG codes. The data from these 191 hospitals was

used as the dataset in this study. The total of 191 hospitals recorded 149,466 childbirth cases from 171 public (133,355 cases) and 20 private hospitals (16,111 cases), all of which contracted their services to The National Insurance House of Romania and used the Ro-DRG payment system. The data collected at the hospital level included the number and percentages of deliveries through each VD or CS Ro-DRG- code applied, as well as the average length of stay for each procedure. Using Excel, we aggregated, analyzed, and illustrated these data through heatmaps reflecting the distribution of CS rates by region and type of provider (public or private).

3 Results

This section presents an overview of CS rates in public and private Romanian hospitals across districts, as informed by the distribution of hospital-level Ro-DRG codes. To interpret these findings, we first describe how the Ro-DRG hospital payment system is used for the reimbursement of costs related to childbirth to inform the interpretation of these findings.

3.1 Childbirth in the Romanian Diagnosis-Related-Group hospital payment system

The Diagnosis-Related Group (DRG) system is a payment method for health service providers that calculates payments based on the complexity of each case determined by diagnosis codes. This retrospective payment mechanism reimburses hospitals for the estimated costs incurred with each episode of care. Hospitals using the DRG system are paid according to the number and type of DRGs reported to the purchaser, in this case, the national insurance provider. The DRG weights, which reflect average costs incurred in treating patients within a DRG, are then converted into monetary value. The DRG weights can vary between countries, reflecting structural factors and national priorities. Some countries may also import relative weights from foreign health systems and adapt them to their national cost data [27, 30].

In Romania, the DRG-based payment system was introduced in 2004, and expanded over time to become one of the core payment systems for Romanian hospitals [26, 28]. This framework has been modified a number of times over the years: initially, the Romanian-adapted DRG system reflected an imported version of the United States (US) model, switching to the more detailed Australian model in 2007, and eventually developing a national version in 2010, the Ro-DRG. The calculation method that converts DRG-reported numbers and weights into monetary value follows the formula below adjusted under Romanian health legislation [31]:

$$CS = No_{case} * PCCL * PWC$$

In this equation, *CS* stands for the contracted sum and is a product of the number of cases (No_{cases}) multiplied by the average patient complexity case level (*PCCL*) and price per weighted case (*PWC*). This model presupposes a prospective allocation of resources based on estimated and past performance (i.e. number of cases/DRGs); it involves negotiations between the provider (hospital) and purchaser (The National Insurance House of Romania); and it implies that future funding can be adjusted to reflect achieved performance. The contracted sum reflects the maximum amount that can be realized in accordance with the monthly reported activity by providers. This means that hospitals will not receive the full amount if they underperform but that they would also risk registering losses if they overperform. To mitigate these potential shortfalls, supplementary monthly funding is potentially available upon request when providers register a higher performance than originally estimated, and every three months, providers can submit petitions to recalculate and be compensated for previously rejected care episodes. In addition to the number of patients admitted, the average complexity rating (i.e. *PCCL*) is critical for generating revenues under this framework. The higher the average complexity-case level is, the greater the expected revenue for the hospital.

Table 1 shows the eight identified Ro-DRG codes used to describe cases (CS and VD) in Romania and their attributed case complexity indicators (*PCCL*). In this study, we reference interchangeably to VDs as 'vaginal birth' or 'natural vaginal birth' and to CSs as 'C-section birth', to retain accuracy of the Romanian-English translation.

Five codes are assigned for VDs and describe a range of medical procedures from least complex: vaginal birth without any complications ($PCCL = 0.6238$) to the most complex: vaginal birth with procedures in the operating room and catastrophic or severe complications or consequences ($PCCL = 1.2412$). Three Ro-DRG codes are available for classifying CS cases: C-section birth without complications ($PCCL = 1.2223$), C-section birth with severe complications or consequences ($PCCL = 1.5752$), and C-section birth with catastrophic complications or consequences ($PCCL = 2.2123$). Among surgical

Table 1 Ro-DRG codes for vaginal deliveries and cesarean deliveries with associated complexity indicator

Ro-DRG Code	Type of case	Description	PCCL – Patient complexity case level
O1021	Vaginal delivery	Natural vaginal birth with procedures in the operating room, with catastrophic or severe complications or consequences	1.2412
O1022	Vaginal delivery	Natural vaginal birth with procedures in the operating room, without complications or consequences	0.9388
O3011	Vaginal delivery	Natural vaginal birth with catastrophic or severe complications or consequences	1.0270
O3012	Vaginal delivery	Natural vaginal birth without complications or consequences	0.7309
O3013	Vaginal delivery	Natural vaginal birth without complications, complications, or other incidents	0.6238
O1011	C – section	C-section birth with catastrophic complications or consequences	2.3123
O1012	C – section	C-section birth with severe complications or consequences	1.5752
O1013	C – section	C-section birth without severe or catastrophic complications or consequences	1.2223

Source of data: Center of Human Resources, Evaluation and Analysis of Health Services of Romania (INMSS), translated from Romanian to English

Table 2 Romanian hospital distribution of deliveries per provider type and case (2020)

	Public	Private	National
Number of Romanian hospitals	171	20	191
% distribution	90%	10%	100%
Total cases	133,355 (100%)	16,111 (100%)	149,466 (100%)
% case distribution	89.2%	10.8%	100%
Case distribution	(% of total Public)	(% of total Private)	(% of total)
Natural delivery	67,132 (50.3%)	3,254 (20.2%)	70,386 (47.1%)
C – Section	66,223 (49.7%)	12,857 (79.8%)	79,080 (52.9%)

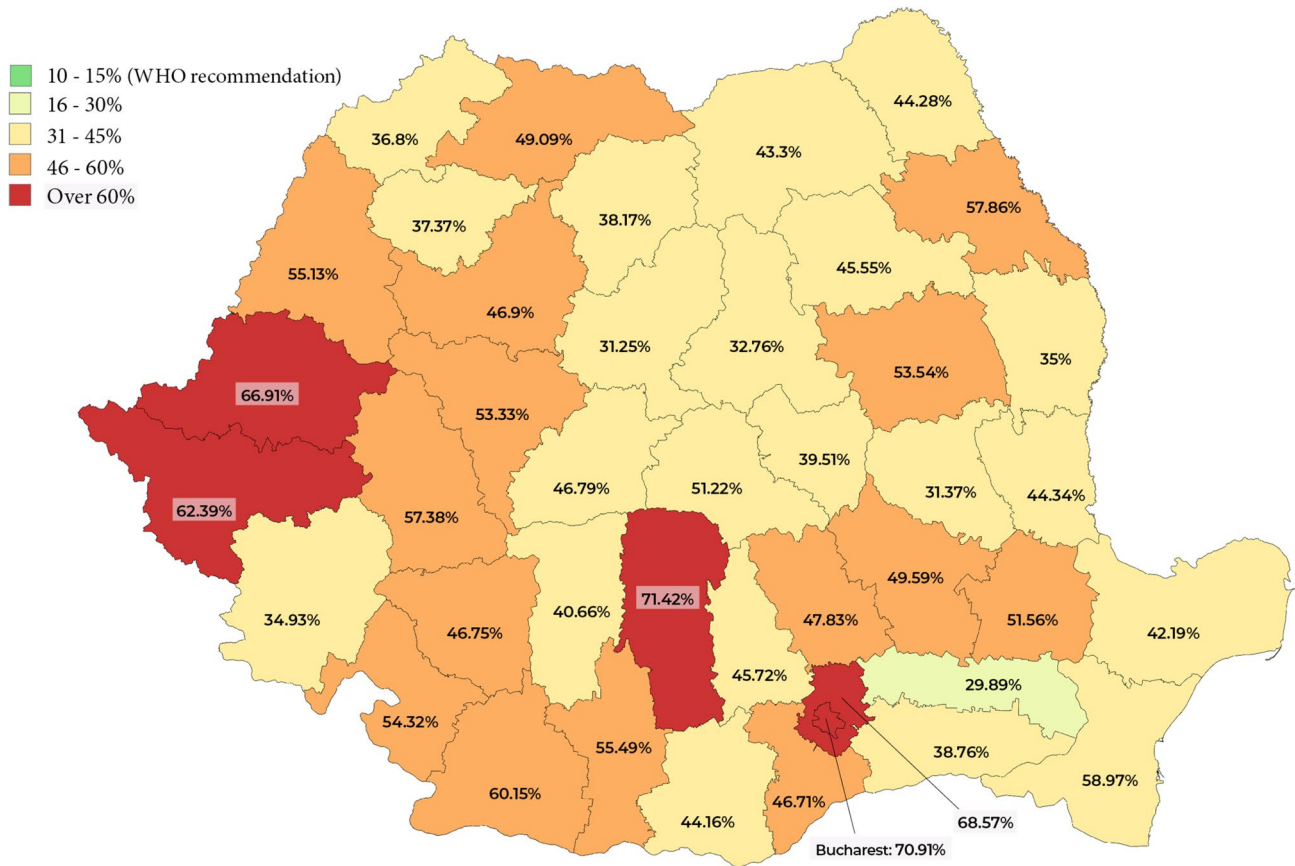


Fig. 1 Regional distribution of CS rates across Romanian districts in 2020

procedures, CSs are overall associated with higher complexity scores than VDs are. The highest complexity score associated with VDs Ro-DRGs was almost as high as the lowest complexity score associated with CSs.

3.2 Distribution of cesarean section rates in Romania

A total of 149,466 childbirth cases were recorded through the Ro-DRG system in 2020 in Romania across the 191 hospitals (Table 2). Approximately 89% of the deliveries (or 133,355) were recorded in the 171 public hospitals, and the remaining ~ 11% (16,111) were recorded in the 20 private hospitals.

At the national level, 52.9% of deliveries were grouped under CS Ro-DRGs. The CS rate was lower in the public sector (49.7%) and markedly higher in the private sector: 79.8% of births in private hospitals were CS deliveries. We highlighted regional differences for all hospitals (Fig. 1), as well as individually for private (Fig. 2) and public hospitals (Fig. 3).

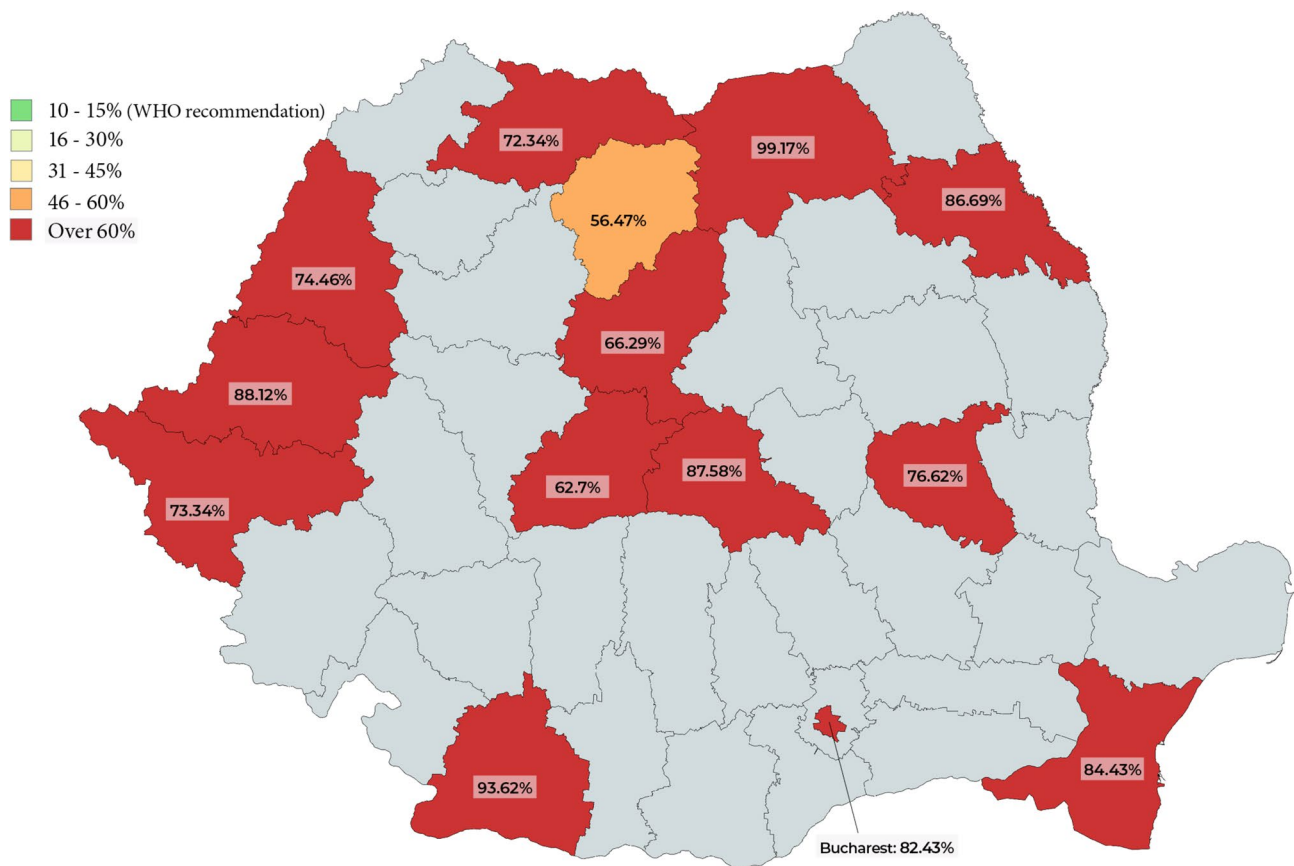


Fig. 2 Regional distribution of CS rates across Romanian districts in 2020 for private hospitals

Figure 1 maps the incidence of CS rates of each Romanian district and in the capital Bucharest, ranging between 29.89% (East-South: district Ialomița) and 71.42% (South-Centre: district Argeș). Across all districts, the average CS rates surpass the WHO recommendation of 10–15% [5], with the highest rates concentrated in the Western and Southern regions, including the capital Bucharest (CS rate 70.91%). Figures 2 and 3 reveal the differences in CS rates between private and public hospitals: in the 14 regions where private hospitals use the Ro-DRG payment system, CS rates in the private sector typically exceed 60%, reaching up to 99.17% (Fig. 2, North: district Suceava). The lowest district-level CS average rate in the private sector is 56.4%, which is higher than the national CS rate of 52.9% and considerably higher than the WHO 15% recommendation. Across all regions that sample both public and private providers, private hospital CS rates surpass public sector rates (Fig. 3), driving up district and national averages. For example, the influence of private provider choices of CS over VD can alter the district-level average rates by up to 13.88% (East-South: district Constanța). In other words, for the district of Constanța, the public sector reports an average of CS rate of 45.09%; this figure reaches 58.97% once private hospitals are accounted for.

To complement these findings and advance the understanding of public/private providers' preferences and behavior in childbirth practices, Table 3 provides the corresponding average length of hospital stay for CS and VD episodes of care.

On average, public facilities record longer stays for both VDs and CSs than does the private sector. In addition, CS episodes of care require longer hospitalization in both types of inpatient facilities: 5.24 days on average in public hospitals, and 3.31 days on average in private hospitals.

3.3 Cesarean section rates across Romanian diagnosis-related-group categories

Table 4 provides an overview of public and private providers' behavior in coding birth delivery cases in the Ro-DRG system, with the associated average hospital length of hospital stay for each code.

When classifying natural deliveries, both public and private hospitals tend to use the code O1021, which is attributed to 'natural vaginal delivery' with procedures in the operating room and severe or catastrophic complications

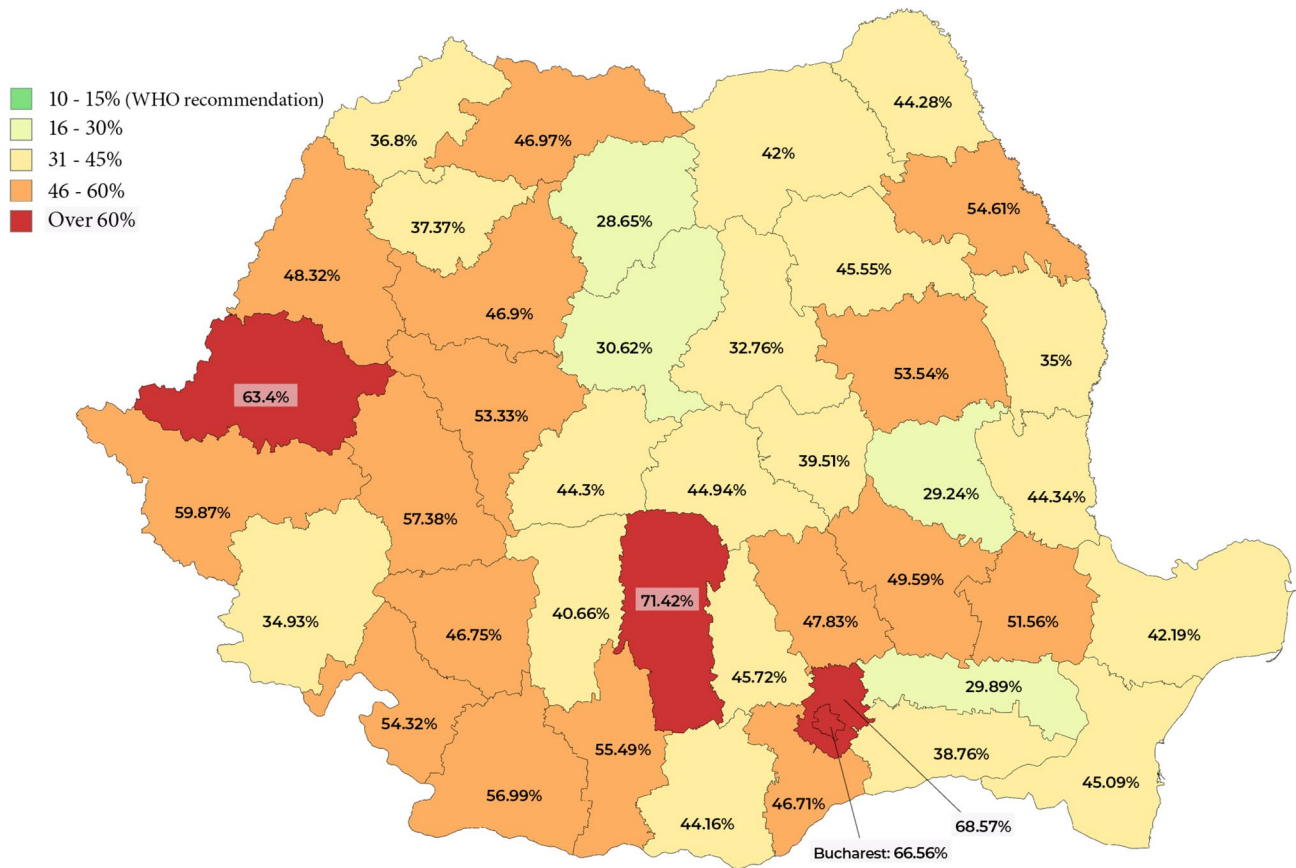


Fig. 3 Regional distribution of CS rates in Romanian districts in 2020 for public hospitals

Table 3 Average length of hospital stay for birth deliveries per type of provider and case

	Public	Private	National
Average length of hospital stay (ALS) all deliveries	4.82	3.24	4.65
Average length of hospital stay (N)	4.41	2.97	4.34
Average length of hospital stay (C)	5.24	3.31	4.93

N = natural deliveries
 C = C-sections
 Measured in: days

or consequences. Overall, 23.4% of all childbirth deliveries in Romania in 2020 were coded under this Ro-DRG classification, which holds the highest attributed complexity level (PCCL) for natural deliveries. In contrast, the overall least commonly used code for VD (in 4.5% of cases) also holds the lowest complexity level: O3013 is associated with natural vaginal birth without complications, consequences, or other incidents. In coding CS cases, both types of providers show a preference for codes O1011 and O1012, which represent CS procedures with complications. By analyzing these percentages at the national level, 41.9% of the total births were coded with the highest complexity scores: O1011 (PCCL 2.3123) and O1012 (PCCL 1.5752).

Across categories, the average length of stay (ALS) is higher in public hospitals than in private hospitals for each and all diagnoses. The highest recorded ALS is 5.61, attributed to the most complex type of CSs performed in public hospitals, while the lowest ALS was 2.60, attributed to the least complex type of VD performed in private hospitals. In general, the ALS for CS procedures is notably greater than the natural delivery ALS for both public and private providers.

Table 4 Romanian distribution of birth deliveries cases per type of provider and Ro-DRG code

	Public Cases	Public ALS*	Private Cases	Private ALS	All Cases	ALS
Total cases	133,355 (100%)	4.82	16,111 (100%)	3.24	149,466 (100%)	4.65
Ro-DRG distribution (N/C) (PCCL)	(% of total Public)		(% of total Private)		(% of total)	
O1021 (N) (1.2412)	33,825 (25.4%)	4.45	1,189 (7.4%)	3.29	35,014 (23.4%)	4.41
O1022 (N) (0.9388)	8,983 (6.7%)	4.25	541 (3.4%)	2.97	9,524 (6.4%)	4.17
O3011 (N) (1.0270)	10,559 (7.9%)	4.59	798 (4.9%)	2.79	11,357 (7.6%)	4.46
O3012 (N) (0.7309)	7,610 (5.7%)	4.38	164 (1%)	2.80	7,774 (5.2%)	4.34
O3013 (N) (0.6238)	6,155 (4.6%)	4.13	562 (3.5%)	2.60	6,717 (4.5%)	4.01
O1011 (C) (2.3123)	24,274 (18.2%)	5.61	4,496 (27.9%)	3.52	28,770 (19.2%)	5.28
O1012 (C) (1.5752)	28,185 (21.2%)	5.15	5,731 (35.6%)	3.21	33,916 (22.7%)	4.82
O1013 (C) (1.2223)	13,764 (10.3%)	4.79	2,630 (16.3%)	3.17	16,394 (11%)	4.53

ALS = average length of stay

N = natural vaginal deliveries

C = C-sections

PCCL = patient complexity case level

4 Discussion

The findings of this study have several significant implications for healthcare policy and practice in Romania and potentially other countries with similar healthcare systems.

At 52.9%, the national incidence of CSs is significantly above the World Health Organization (WHO) recommended rate of 10–15%, raising substantial public health concerns. Excessive CSs can lead to increased health risks for both mothers and newborns, such as infections, longer recovery times, and complications in subsequent pregnancies. Moreover, the trend of high CS rates in Romania seems to be growing over time: our 2020 study calculated a 52.9% national rate, compared to an estimated 46.9% in 2018 [8], and an official CS rate of 40.1% from 2013 [12]. This continuous increase over the years reflects a deepening reliance on CSs and suggests that efforts to curb this trend have been insufficient or ineffective. Furthermore, the regional-level analysis reveals significant regional disparities, with higher CS rates found in wealthier districts and the capital city, Bucharest. This disparity may be influenced by several factors previously linked with wealthy regions, including maternal preferences for the convenience and perceived safety of CSs, or physician recommendations [14, 32–34]. At a national rate of 52.9%, many CSs might arguably be medically unnecessary, leading to avoidable health complications and increased healthcare costs. However, the data available for this study does not lend itself for the testing of this hypothesis.

Second, this study highlights stark differences in CS rates between public and private hospitals in Romania, with private hospitals exhibiting a markedly greater percentage (79.8%) of CSs than public hospitals (49.7%). This striking discrepancy can be read to support the argument that private hospitals are financially incentivized to perform CSs over VDs, with the prospect of higher reimbursements attached. The fact that the average length of hospital stay in private hospitals is lower than in public facilities for all childbirth diagnoses reinforces this argument: the costs associated with shorter hospitalizations are lower, while the payment is constant, potentially motivating private hospitals to shorten hospital stays to maximize profits. It is important to note the private hospitals sampled for this study are likely financed both through subsidy contracts with The National Insurance House of Romania through the Ro-DRG payment system, and through complementary OOP payments. While maternal preferences for CS for convenience and perceived safety [14] are known to increase CS rates, the high dominance of CSs in private hospitals

may also signal misallocation of resources, where financial incentives overshadow clinical necessity. This can lead to inefficiencies in healthcare delivery, and potentially compromise the quality of maternal care overall in the absence of targeted policy interventions to promote evidence-based clinical practices.

Third, the study's Ro-DRG analysis points to possible 'upcoding' practices (i.e. using a higher complexity code to classify an episode of care) in both public and private hospitals for childbirth cases, with 95.5% of deliveries coded as either involving surgical procedures (CSs), or involving severe complications. First, CSs are associated with higher complexity scores and thus higher payments, potentially providing a strong financial motive for hospitals to favor these procedures over natural deliveries. Second, the data indicate that both types of hospitals prefer Ro-DRG codes with higher complexity levels when classifying between procedures of the same type (CS or VD), which may not accurately reflect the true medical necessity of the cases. In contrast, other countries report significantly higher rates of spontaneous, or non-instrumental VD: for instance, in Australia, more than 50% of all births in 2021 were non-instrumental VDs [35], and in the United Kingdom, it is estimated that more than 75% of all VDs are spontaneous and do not require clinical interventions [36]. In Romania, the pattern of classifying most deliveries as non-spontaneous can suggest that the financial incentives inherent in the Ro-DRG payment system may influence hospitals to classify deliveries as more complex than they actually are. Currently, practices of upcoding are classified as errors when detected, without significant consequences for the service provider, who in the worst-case scenario is asked to return the funds for the 'error' case [37]. Auditing mechanisms to identify and prevent upcoding practices are currently missing from Romanian health legislation.

In fact, the Ro-DRG reimbursement system is built on such financial incentives [30]: paid per case and in accordance to the complexity of the case, hospitals are incentivized to reduce costs and generate more revenue per treated patient. However, these incentives can trigger response strategies from hospitals that seek to optimize efficiency. These can have both positive and negative implications for quality of care. For example, in trying to reduce the costs per patient, providers can try to reduce the length of stay either by optimizing internal care pathways (positive effect) or by unjustifiably discharging patients early (negative effect). In addition to these potential strategies, there is evidence that hospitals may be sensitive to market incentives since they implement a DRG-based system [38]. Faced with a clinical choice, physicians might be incentivized to choose the more complicated procedure, or the hospital may simply 'upcode' a case as more complicated to yield higher revenues. In light of such potential consequences of adopting a DRG-based system, it is therefore essential to consider complementary accountability frameworks that measure and mitigate for these unintended negative effects.

This study merely touches the surface of a complicated issue – the implications of very high CS rates for health financing structures and health policy, as well as the incentives and systemic inefficiencies that trigger these clinical choices. The aim of this study was to provide an overview of the landscape of birth delivery distributions in Romanian at a given moment in time (2020), and the results of this study need to be interpreted carefully. First, not all hospitals upload the Ro-DRG data; for the listed entities using the Ro-DRG payment method, 34.8% of the institutions did not make their Ro-DRG data available. Second, the impact of Ro-DRGs on CS rates is difficult to measure since some hospitals may receive other payment methods at the same time for which there is no reported data available to include in this study (e.g. fee-for-service, or OOP in private facilities). Third, we lack supplementary data to contextualize and complement the Ro-DRG-related findings, particularly concerning other maternal characteristics such as: income level, or demographic and clinical information typically used to assess, monitor, and compare CS rates within and across healthcare facilities (e.g. gestational age, number of fetuses) [39].

Future comparative studies of year-on-year differences to identify potential legislative, political, and economic factors behind identified patterns of public and private providers' behavior could shed more light on the subject. Moreover, the district-level analysis presented in this study provides a good base for expanding research across regions and individual districts. By providing valuable context, the regional results of this study can be contextualized to create a base for targeted regional health reform. Finally, a qualitative study to better understand maternal and clinical choices underlying these findings could serve to advance the understanding of national and regional CS rates to effectively inform health policy.

5 Conclusion

This study describes CS rates in Romania for the year 2020, with a particular focus on differences between public and private hospitals and the financial incentives generated by the Ro-DRG hospital payment system. Our findings reveal a national CS rate of 52.9%, which far exceeded the World Health Organization's recommended rate of 10–15%. We found

that CS rates vary greatly between public and private hospitals, with private hospitals exhibiting a notably greater incidence of CSs (79.8%) than in public hospitals (49.7%). This discrepancy can be linked to the existence of financial incentives to increasing CS rates, as private hospitals seek to maximize revenue and therefore might be particularly inclined toward the more profitable CSs. Additionally, the analysis points to potential upcoding trends in both public and private hospitals, where childbirth cases are classified as more complex to secure higher reimbursements; within the subcategories for both CSs and VDs, higher complexity codes are most commonly used.

The findings indicate systemic inefficiencies and financial motivations that may compromise the quality of maternal care. Addressing these issues requires targeted policy interventions to ensure that financial incentives align with clinical necessity and promote evidence-based practices. To address the high rates of C-sections, policymakers should consider revising the financial incentives within the Ro-DRG payment system to ensure that payments for VDs reflect their actual clinical complexity and promote their use where medically appropriate. Additionally, introducing stricter audit mechanisms to monitor coding practices and offering educational programs for healthcare professionals on the benefits of natural childbirth could further align medical practices with clinical necessity. Future research should extend the analysis over a broader timeframe and incorporate qualitative data to better understand the underlying factors influencing CS rates and inform effective health policy reforms.

Author contributions I.S.: Drafted the work, acquired, analyzed, and interpreted the data. She is accountable for all aspects of the work. N.W.: Made substantial contributions to the analysis and presentation of the study, and revised it critically. D.E.: Made substantial contributions to the design of the study and contributed to the analysis and presentation of the study.

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Data availability The dataset generated and analyzed during the current study, is available to the public in the Zenodo repository, <https://doi.org/10.5281/zenodo.12566295>.

Code availability Not applicable, codes were not generated during this study.

Declarations

Ethics approval and consent to participate This is an observational study that utilized statistical data from the public domain, and does not involve human participants, therefore not requiring ethical approval.

Competing interests The authors declare no competing interests.

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