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# Cesarean-associated share of live-birth records by region in Saudi Arabia, 2024: a short report

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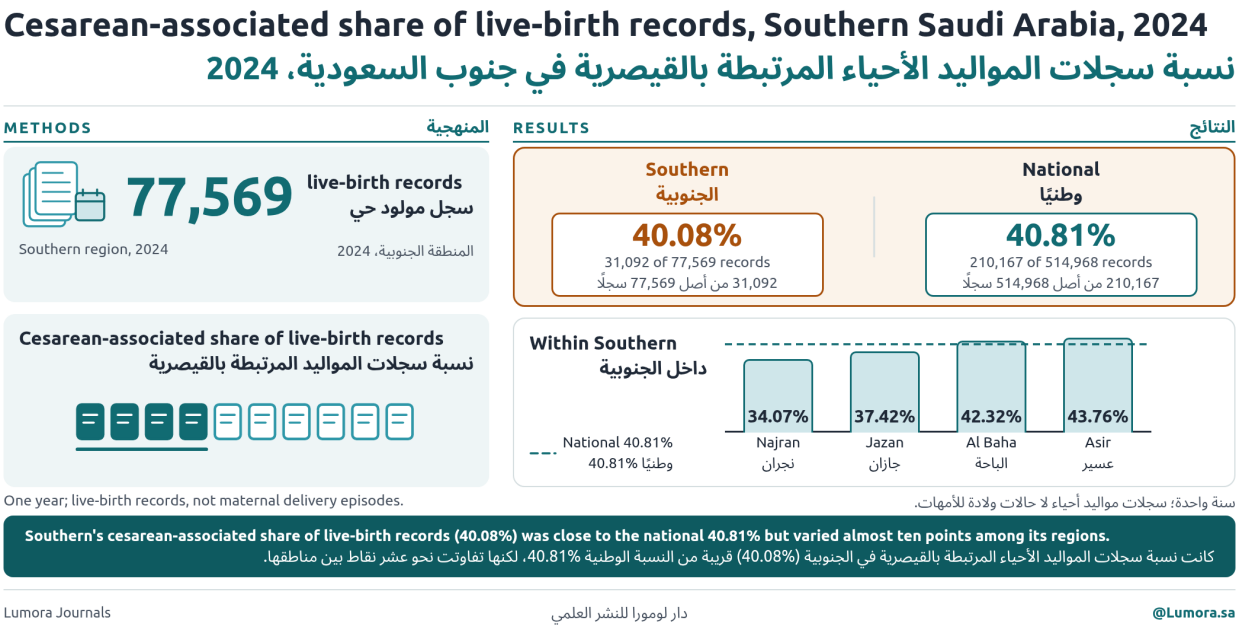
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Graphical abstract




Graphical abstract: Southern's cesarean-associated share of live-birth records (40.08%) was close to the national 40.81% but varied almost ten points among its regions. Designed by the Lumora Journals production team using hand-coded HTML/SVG rendered in Google Chrome.


## Abstract

**Background:** The Ministry of Health yearbook classifies live-birth records by type of delivery without identifying maternal delivery episodes. We describe the regional cesarean-associated share of live-birth records, with a focus on the Southern grouping.

**Methods:** We reconstructed Ministry of Health Statistical Yearbook 2024 Table 4-35, whose stated source is the Birth Notification Registration System, and reconciled component counts with the published total. The 20 reporting units were mapped to the thirteen administrative regions and then to five analytical groups. The primary measure was cesarean-associated live-birth records divided by all recorded live births, compared with the national share; a secondary calculation excluded records with undefined delivery classification. Maternal episode linkage, parity, previous cesarean delivery, gestational age, indications and outcomes were unavailable. Source inspection preceded the written analysis plan; the analysis is exploratory, with no sampling confidence intervals or clinical-appropriateness inference.

**Results:** Southern, comprising Asir, Jazan, Najran and Al Baha, recorded 77,569 live-birth records: 46,476 in the source's normal-delivery category, 31,092 cesarean-associated and one with undefined delivery classification. The cesarean-associated share was 40.08%, compared with 40.81% nationally, and was unchanged at two decimals when the undefined record was excluded. Constituent administrative-region shares were 43.76% in Asir, 37.42% in Jazan, 34.07% in Najran and 42.32% in Al Baha. The other group shares were 41.41% in Central, 43.07% in Western, 36.03% in Eastern and 40.41% in Northern. Nationally, 210,167 of 514,968 live-birth records were cesarean-associated, and all reconstructed totals matched the source.

**Conclusions:** The Southern share was close to the national share but concealed a range of almost ten percentage points among its regions. The table supports descriptive comparison of recorded live births, not maternal cesarean-delivery rates, indications or appropriateness.

Keywords: Cesarean Section; Live Birth; Delivery, Obstetric; Vital Statistics; Saudi Arabia

## Introduction

A live-birth table may count infants, whereas a clinical cesarean-rate study counts women or delivery episodes, and a multiple pregnancy can generate more than one live-birth record from one delivery. Saudi studies have described cesarean delivery nationally and in specific hospitals and regions [1–6], often with clinical classification that an aggregate table lacks [4,7]. Global estimates and the WHO statement apply to their own populations and definitions [8,9].

The Ministry of Health Statistical Yearbook 2024 reports live births by type of delivery for all health sectors and 20 reporting units. The national share is printed in the source, but its regional composition and the implications of its live-birth denominator have not been described. A longitudinal analysis of the same yearbook series examined capacity and utilization indicators and does not report births or delivery mode [10].

We aimed to describe the cesarean-associated share of live-birth records in the thirteen administrative regions and five analytical groups, with a focus on the Southern grouping, relative to the national share.

## Methods

We reanalysed Table 4-35 of the Ministry of Health Statistical Yearbook 2024 (https://www.moh.gov.sa/en/Ministry/Statistics/book/Documents/Statistical-Yearbook-2024.xlsx; SHA256 959a27fbe4a7ef7b5726c679303d3251aea8b638370289b8d055705e53ea2649), “Live Births in all Health Sectors by Type of Delivery, Gender and Nationality in MoH Branches & Offices, 2024G”, whose stated source is the Birth Notification Registration System [11,12]. The table reports “Normal”, “C.S.”, “Undefined” and “Total” live births for 20 Ministry of Health branches and offices, with separate sex and nationality margins. The workbook was inspected before the written analysis plan was prepared, so the analysis is exploratory.

No participants were recruited. The analytical observations are regional aggregates of recorded live births; no individual maternal or infant records were accessed. We use “birth records” as the denominator label to preserve the recorded counting unit, because the annual totals cannot establish the relationship among individual women, delivery episodes and infants.

The 20 reporting units were assigned to the thirteen administrative regions (Supplementary Table S1) and these to five analytical groups—Central, Western, Eastern, Southern and Northern—following a published convention [13]. The primary quantity was “C.S.” records divided by all live-birth records, described as a cesarean-associated share rather than a maternal rate; a secondary calculation excluded undefined records. Group counts were summed before division. Component counts were reconciled with the national total row.

No inferential statistics were calculated because the table reports complete recorded totals, and infant records may be dependent within a delivery. Sex and nationality margins are not cross-tabulated with delivery type and were not analysed. STROBE and RECORD guided the reporting [14,15].

An infant-based live-birth count and a maternal delivery-episode count can differ because one delivery may result in more than one infant. The table has no maternal or episode identifier, no plurality cross-tabulation and no linked stillbirth counts, whereas a clinical maternal cesarean rate is defined over a delivery population.

The unit-to-region mapping, source-row export, unrounded results and code are provided as Supplementary Material S1.

The reconstruction checked that normal, cesarean-associated and undefined counts summed to each reported total, and the national delivery, sex and nationality counts were reconciled with the published total row. These checks establish internal consistency with the workbook; they do not validate the registration system or establish complete capture.

Shares are reported to two decimals; unrounded values are in Supplementary Material S1.

## Results

The 20 units recorded 514,968 live-birth records: 304,796 “Normal”, 210,167 “C.S.” and five “Undefined”; all components matched the source total row. The national cesarean-associated share was 40.81% (Table 1).

Southern recorded 31,092 cesarean-associated records among 77,569 live-birth records (40.08%), 0.73 percentage points below the national share. Its regions ranged from 34.07% in Najran and 37.42% in Jazan to 42.32% in Al Baha and 43.76% in Asir (Table 1; Figure 1).

The other group shares were 41.41% in Central, 43.07% in Western, 36.03% in Eastern and 40.41% in Northern. Across all regions, shares ranged from 32.04% in Al Jouf to 44.75% in Hail, and nine regions were above the national share.

Excluding undefined records changed no group share at two decimals (Southern 40.083% vs 40.084%).

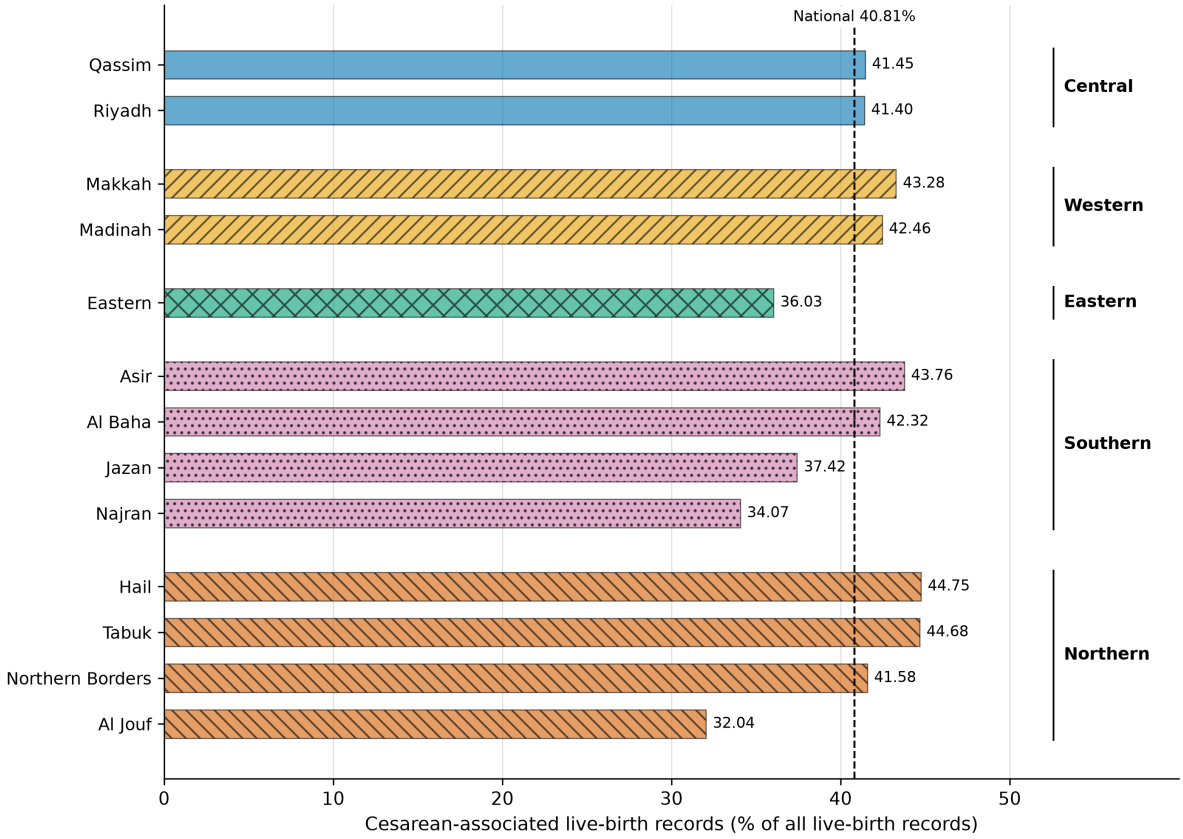
**Table 1.** Live births by type of delivery, administrative region and analytical group, Saudi Arabia, 2024

| Region | Normal | C.S. | Undefined | Total live births | Cesarean-associated share (%) |
|---|---|---|---|---|---|
| Central group | 95,047 | 67,183 | 1 | 162,231 | 41.41 |
| Riyadh | 80,479 | 56,868 | 1 | 137,348 | 41.40 |
| Qassim | 14,568 | 10,315 | 0 | 24,883 | 41.45 |
| Western group | 84,897 | 64,224 | 1 | 149,122 | 43.07 |
| Makkah | 62,825 | 47,938 | 0 | 110,763 | 43.28 |
| Madinah | 22,072 | 16,286 | 1 | 38,359 | 42.46 |
| Eastern group | 47,711 | 26,874 | 1 | 74,586 | 36.03 |
| Eastern | 47,711 | 26,874 | 1 | 74,586 | 36.03 |
| Southern group | 46,476 | 31,092 | 1 | 77,569 | 40.08 |
| Asir | 20,171 | 15,698 | 0 | 35,869 | 43.76 |
| Jazan | 13,830 | 8,271 | 0 | 22,101 | 37.42 |
| Najran | 9,359 | 4,836 | 0 | 14,195 | 34.07 |

| Region | Normal | C.S. | Undefined | Total live births | Cesarean-associated share (%) |
|---|---|---|---|---|---|
| Al Baha | 3,116 | 2,287 | 1 | 5,404 | 42.32 |
| Northern group | 30,665 | 20,794 | 1 | 51,460 | 40.41 |
| Tabuk | 8,931 | 7,212 | 0 | 16,143 | 44.68 |
| Hail | 6,723 | 5,447 | 1 | 12,171 | 44.75 |
| Northern Borders | 4,404 | 3,134 | 0 | 7,538 | 41.58 |
| Al Jouf | 10,607 | 5,001 | 0 | 15,608 | 32.04 |
| National | 304,796 | 210,167 | 5 | 514,968 | 40.81 |

Notes. Column headings “Normal”, “C.S.” and “Undefined” are those of the source; group rows sum their regions. The denominator is live-birth records, not maternal delivery episodes. Source: Ministry of Health Statistical Yearbook 2024, Table 4-35 (Birth Notification Registration System).

**Figure 1.** Cesarean-associated share of live-birth records by administrative region, Saudi Arabia, 2024.




Notes. Bars show administrative regions grouped by analytical region; colour and fill pattern distinguish the groups, and each bar is labelled with its value. The dashed line marks the national share (40.81%). The denominator is live-birth records, not maternal delivery episodes. Source: Ministry of Health Statistical Yearbook 2024, Table 4-35.

## Discussion

Southern’s share of cesarean-associated live-birth records was close to the national 40.81%, but the combined value concealed a range of almost ten percentage points among its regions, a similar range

occurred within the Northern group (12.71 percentage points), whereas the Central and Western regions differed by less than one point.

The share is not a maternal cesarean rate: one delivery can produce several live-birth records [16,17], and the table contains no indications, parity, previous cesarean delivery or gestational age, so no value is described as excessive or avoidable [18,19].

Earlier Saudi figures used other units and coverage: 19.1% of deliveries in government hospitals in 2006, without private hospitals [1], and a rate above 15% in one armed forces hospital in 2007–2008 [2]. Global estimates indicate that 21.1% of women gave birth by caesarean section in 2010–2018 [8]. Because the unit, year and sector coverage differ, differences from the present share cannot be attributed to practice change. Studies of specific Saudi populations add clinical detail beyond the table [3,6,20–23].

The analysis covers one year; earlier editions report deliveries in government hospitals and private-sector births without delivery type [24–26], so a comparable regional series cannot be built from them. Coverage outside the notification system, plurality and residence are unknown.

The regions also differ in reporting population, institutional composition and referral pathways, and the table does not align births with maternal residence. A regional label therefore describes where births were reported, not the risk experienced by resident women or the performance of a regional maternity system.

Linked maternal-episode data with clinical classification would be needed to estimate maternal rates or assess appropriateness [7,20–23].

Institutional studies from Abha and Jazan are relevant to the Southern clinical context but concern specified maternal groups or repeat procedures [21,22], and maternal-request, parity and age research identifies dimensions absent from the table [20,23]. Robson-based comparisons show how a structured case-mix framework makes comparisons informative when the required data exist [18,19]; the aggregate table cannot reconstruct that framework.

Undefined delivery classifications were rare, and removing them changed group shares only beyond the second decimal. This is a reproducible observation about the source denominator; it does not show that measurement error is negligible or that delivery mode is completely ascertained. Likewise, the undefined-sex and nationality margins cannot be linked to delivery classification.

The workbook digest, unit-to-region mapping, source-row export, scripts and unrounded results (Supplementary Material S1) make the calculation reproducible, and the national reconciliation guards against dropped or double-counted rows. These strengths concern transparency and computational integrity, not clinical validity.

## Conclusions

In 2024, 40.08% of Southern live-birth records were cesarean-associated, close to the national 40.81%, with differing shares among its four regions. The table supports a descriptive comparison of recorded live births, but not maternal cesarean-delivery rates, indications, appropriateness or outcomes.

## Declarations

**Ethics statement:** This study analysed published aggregate administrative records from the Ministry of Health Statistical Yearbook 2024 [11]; it involved no participants, no new clinical observations and no identifiable individual records. As a secondary analysis of publicly available data, the study was exempt from ethics review.

**Data and code availability:** The source workbook is publicly available [11]. The unit-to-region mapping, source-row export, unrounded result files and the Python scripts that reproduce all reported values and Figure 1 are provided as Supplementary Material S1 and Supplementary Table S1.

**Related submissions:** Analyses of other tables of the same 2024 yearbook have been submitted separately to this journal and are listed in the cover letter; they concern different services and regions, and none analyses live births or delivery classification.

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**Conflicts of interest:** The authors declare no competing interests.

**Author contributions:** [Pending: CRediT author contributions and confirmation that all authors approved the final version — to be supplied by the authors]

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## Abbreviations

Abbreviations. C.S., cesarean section (source column heading); RECORD, REporting of studies Conducted using Observational Routinely-collected health Data; SHA256, Secure Hash Algorithm 256-bit; STROBE, Strengthening the Reporting of Observational Studies in Epidemiology; WHO, World Health Organization.

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