A step towards better audit: The Robson Ten Group classification system for outcomes other than cesarean section

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Abstract
Introduction: The Robson Ten Group Classification System is widely used for the audit of cesarean section (CS) rates. However, CS rate alone is a poor quality indicator and should be balanced with other obstetric endpoints. The aim of this study was to evaluate whether Swedish national data on obstetric outcomes other than CS, stratified by the Robson classification, could be analyzed in a useful way.

Material and methods: All births in Sweden from 2017 through 2020 recorded in the nationwide Swedish Pregnancy Register were categorized using the Robson classification with subdivision of some groups. Five outcomes were explored: CS, operative vaginal delivery, postpartum hemorrhage, obstetric anal sphincter injury (OASIS) and Apgar score <7 at 5 minutes. Rates of each outcome and contribution of each group to the total outcome rate were calculated.

Results: The largest Robson groups were nulliparous and multiparous women with single-term cephalic pregnancies, unscarred uterus and spontaneous labor. Intrapartum CS rates were highest for multiple pregnancies, women with induced labor after previous CS, and nulliparous women with induced labor. Nulliparous women and multiparous women with a previous CS with attempted vaginal birth had the highest operative vaginal delivery and OASIS rates. The postpartum hemorrhage rate was highest for multiple pregnancies and transverse lie, followed by prelabor CS in nulliparous and multiparous women with single-term cephalic pregnancies and unscarred uterus. The highest rates of Apgar score <7 at 5 minutes were observed in preterm deliveries, multiple pregnancies, transverse lie and breech presentation. The largest contribution to the total CS rate was made by women with previous CS delivered by prelabor CS, and nulliparous women with induced or spontaneous labor. The largest contribution to all other outcomes was made by nulliparous women with spontaneous or induced labor and, notably, multiparous women with spontaneous labor and unscarred uterus.
Conclusions: The Robson classification provides a useful framework for analyzing CS rates along with rates of operative vaginal delivery, OASIS, postpartum hemorrhage and low Apgar score. Parallel interpretation of several outcomes allows a systematic and multidimensional audit, helpful for families and healthcare professionals, and can be used for comparisons, assessment of trends and subpopulations.

Key message
In addition to cesarean section rates, the Robson classification is useful for audit of operative vaginal delivery, postpartum hemorrhage, obstetric anal sphincter injuries, and low Apgar scores. This facilitates a balanced risk assessment and improvement of quality of obstetric care.

1 | INTRODUCTION

Ten prospectively determined, mutually exclusive, totally inclusive, and clinically relevant groups of women giving birth, known as “Robson groups”, are currently widely used for audit of cesarean sections (CS).1-4 The classification system was described in 2001 by Michael S. Robson, which suggested stratifying women giving birth according to parity, number of fetuses, fetal presentation, gestational length, and mode of onset of labor for the analysis of CS rates.5 The Robson classification can be used for assessment of CS rates within groups but also for assessment of the contribution by each group to the total CS rate, as larger groups, even with lower CS rates within groups, can have high overall impact on total CS burden. This classification has become a tool to compare the quality of obstetric care, such as the rate of intrapartum CS in first-time mothers with a singleton term fetus in cephalic presentation and spontaneous onset of labor—the so called Robson 1 CS—which is especially important to control.6-7 In Sweden, the Robson Ten Group Classification System has been used for the audit of CS rates since 2002, both at hospital level and national level. Since 2013, the CS audit includes annual meetings with obstetricians and midwives from all Swedish labor wards.

The CS rate in Sweden is low.2,8,9 The natural question is: is there any price? It has been argued that the CS rate alone is a poor quality indicator and it should be balanced by other maternal and perinatal outcomes to give a more nuanced and complete picture.10-12 Results of randomized controlled trials can differ from those observed in clinical practice and have limited generalizability.13-16 To allow valid assessment and improvement of obstetric care at any level, it is essential to develop a reliable and feasible tool for the analysis of complex real-world data, ideally prospectively collected, in a predefined and structured way.

We suggest that the Robson Ten Group Classification System can be used for systematic audit of the important obstetric outcomes other than CS in all Robson groups. A few attempts have been made to apply the Robson classification when studying some outcomes separately, for example, operative vaginal delivery (OVD), obstetric anal sphincter injury (OASIS) and postpartum hemorrhage (PPH).17-20 However, parallel assessment of several outcomes side by side using Robson groups is rare.21-23 The aim of this study was to evaluate whether Swedish national data on five obstetric outcomes from 2017 to 2020 grouped according to the Robson Ten Group Classification System could be presented and analyzed in a useful way.

2 | MATERIAL AND METHODS

The data were collected from the Swedish Pregnancy Register, which contains prospectively collected detailed information on pregnancy, childbirth and postnatal care from 39 of 44 Swedish hospitals with labor wards, ie 91% of all births in Sweden.24 There are virtually no births outside hospitals in Sweden. All births in the register from 2017 through 2020 were included. We retrieved the data aggregated on national level.

The births were categorized using the Robson Ten Group Classification System and splitting groups 2, 4, 5, 8 and 10 into subgroups to visualize mode of labor onset (Table 1). This classification has been in national use in Sweden since 2002.5,25

Nulliparous women are defined as women with no previous delivery and multiparous women are defined as women with at least one previous delivery (from 22 weeks, all routes of delivery). Women were allocated to the Robson groups as described in the flowchart recommended by WHO.26

The outcomes were retrieved from the Swedish Pregnancy Register based on a combination of marked checkboxes and the Swedish version of the International Classification of Diseases version 10 (ICD-10) codes for CS, OVD and OASIS, on filled checkboxes for Apgar score at 5 minutes and PPH in milliliters of blood loss (PPH was defined as a blood loss of 1000 mL or more according to the Swedish definition).

The relative size of the Robson group was calculated as number of women in each group divided by the total number of women who gave birth in Sweden 2017–2020. Rates of maternal outcomes (CS, OVD, OASIS and PPH), were calculated as the number of the outcomes in each Robson group divided by the number of women in the same group. Rate of Apgar score <7 at 5 minutes was calculated as the number

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of newborns with Apgar score <7 at 5 minutes in each Robson group divided by the number of live-born newborns in the same group.

The relative contribution of each Robson group to the total outcome was expressed as the number of cases of the outcome (CS, OVD, OASIS, PPH and Apgar score <7 at 5 minutes) divided by the total number of cases of the outcome (CS, OVD, OASIS, PPH and Apgar score <7 at 5 minutes).

2.1 | Ethical approval

Ethical approval was not needed according to Swedish regulation, as no individual data were used. Women give consent to data collection in the Swedish Pregnancy Register at booking in antenatal care and have the possibility to opt out.

### RESULTS

The largest Robson groups were nulliparous and multiparous women with single-term cephalic pregnancies and a spontaneous onset of labor and without previous CS (groups 1 and 3), followed by nulliparous and multiparous women with induced labor and without previous CS (groups 2a and 4a) (Table 2). Women with previous CS (group 5) represented a group of similar size (Table 2).

The highest intrapartum CS rates were seen in women with multiple pregnancies (groups 8a and 8b), women with previous CS with induced labor (group 5b) and nulliparous women with single-term cephalic pregnancies with induced labor (group 2a) (Table 3). Nulliparous women and women with previous CS who attempted vaginal birth (groups 1, 2a, 5a and 5b) had the highest OVD rates (Table 3). The PPH rate was highest in groups with multiple...
pregnancies and transverse lie (groups 8a, 8b, 8c and 9), followed by prelabor CS (groups 2b, 4b and 10c) (Table 3). OASIS was most prevalent in nulliparous women with attempted vaginal birth and women with a previous CS (Table 3). The rate was similar in nulliparous women with induced and spontaneous labor (groups 1 and 2a), whereas the rate was lower in women with a previous CS and induced labor (group 5b) than spontaneous labor (group 5a) (Table 3). The highest rate of Apgar score \(< 7\) at 5 minutes was observed in preterm deliveries, multiple pregnancies, transverse lie and breech presentation (groups 7, 8a, 8c, 9 and 10c) (Table 3). The number of cases for each of the five outcomes (CS, OVD, OASIS, PPH and Apgar score \(< 7\) at 5 minutes) in each Robson group can be seen in Supporting Information Table S1.

The largest contribution to the total CS rate was made by women with previous CS delivered by a repeat prelabor CS (group 5c), amounting to 21.1% of all CS (Table 4, Figure 1, Supporting Information Table S2). The second and third largest contributing groups were nulliparous women with single-term cephalic pregnancies with induced or spontaneous labor (groups 2a and 1), together amounting to 23.6% of all CS (Table 4, Figure 1). The largest contribution to all other outcomes (OVD, OASIS, PPH and Apgar score \(< 7\) at 5 minutes) was made by nulliparous women with spontaneous or induced labor and multiparous women with spontaneous labor and unscarred uterus (groups 1, 2a and 3) (Table 4, Figure 1). The contribution presented as relative percentage can be seen in Table S2.

## DISCUSSION

In this paper we present Swedish national obstetric outcome data from the years 2017–2020, grouped according to the Robson Ten Group Classification System with a subdivision to visualize the mode of labor onset. The data can be analyzed in different ways depending on focus and goal. Comparing rates of chosen outcomes between Robson groups, and assessing different outcomes

### TABLE 2

| Robson group | Women (n) | Live-born infants (n) | Relative size of groups (%) | Age > 35 years (%) | BMI >30 (%) | Smoking during pregnancy\(^a\) (%) | Pre-gestational diabetes\(^b\) (%) | Birthweight \(>4000\) g (%) |
|--------------|-----------|-----------------------|-----------------------------|-------------------|-------------|--------------------------------------|-------------------------------|-----------------------------|
| 1            | 114,657   | 114,584               | 27.5                        | 10.1              | 10.3        | 3.3                                  | 0.3                           | 12.3                        |
| 2            | 45,027    | 44,864                | 10.8                        | 19.1              | 17.6        | 3.6                                  | 1.7                           | 19.5                        |
| 2a           | 39,340    | 39,188                | 9.4                         | 16.9              | 19.2        | 3.6                                  | 1.7                           | 20.4                        |
| 2b           | 5,687     | 5,676                 | 1.4                         | 34.3              | 15.4        | 3.4                                  | 1.6                           | 13.3                        |
| 3            | 140,839   | 140,751               | 33.8                        | 25.2              | 13.9        | 3.7                                  | 0.4                           | 20.4                        |
| 4            | 39,575    | 39,432                | 9.5                         | 32.9              | 21.7        | 5.0                                  | 1.8                           | 26.3                        |
| 4a           | 34,258    | 34,123                | 8.2                         | 32.1              | 24.2        | 5.2                                  | 1.9                           | 27.7                        |
| 4b           | 5,317     | 5,309                 | 1.3                         | 38.3              | 15.3        | 3.6                                  | 1.1                           | 17.1                        |
| 5            | 39,592    | 39,527                | 9.5                         | 35.7              | 20.8        | 4.2                                  | 1.7                           | 19.2                        |
| 5a           | 17,605    | 17,586                | 4.2                         | 29.9              | 17.6        | 3.8                                  | 0.7                           | 18.2                        |
| 5b           | 6,618     | 6,586                 | 1.6                         | 33.5              | 28.7        | 4.6                                  | 2.6                           | 26.1                        |
| 5c           | 15,369    | 15,355                | 3.7                         | 43.3              | 24.3        | 4.4                                  | 2.3                           | 17.4                        |
| 6            | 7,289     | 7,196                 | 1.7                         | 17.8              | 12.9        | 3.0                                  | 1.0                           | 6.2                         |
| 7            | 4,445     | 4,297                 | 1.1                         | 38.3              | 21.6        | 4.9                                  | 2.2                           | 9.7                         |
| 8            | 5,807     | 11,586                | 1.4                         | 28.0              | 16.0        | 4.3                                  | 1.0                           | 0.1                         |
| 8a           | 1,891     | 3,749                 | 0.5                         | 24.7              | 17.1        | 4.4                                  | 0.8                           | 0.0                         |
| 8b           | 2,028     | 4,028                 | 0.5                         | 27.2              | 14.1        | 4.1                                  | 0.9                           | 0.0                         |
| 8c           | 1,888     | 3,809                 | 0.5                         | 32.2              | 21.7        | 4.3                                  | 1.4                           | 0.2                         |
| 9            | 1,141     | 1,133                 | 0.3                         | 46.5              | 24.7        | 4.3                                  | 1.6                           | 13.3                        |
| 10           | 17,541    | 16,966                | 4.2                         | 23.5              | 17.4        | 6.2                                  | 4.3                           | 1.8                         |
| 10a          | 10,771    | 10,681                | 2.6                         | 20.6              | 16.3        | 5.8                                  | 2.1                           | 0.8                         |
| 10b          | 3,314     | 2,886                 | 0.8                         | 24.4              | 24.3        | 7.0                                  | 7.2                           | 3.1                         |
| 10c          | 3,456     | 3,399                 | 0.8                         | 31.4              | 23.4        | 6.6                                  | 8.4                           | 3.6                         |
| Undefined    | 1,304     | 1,304                 | 0.3                         | 16.8              | 0.0         | 0.0                                  | 0.4                           | 17.7                        |
| Total        | 417,217   | 421,640               | 100.0                       | 22.1              | 15.5        | 3.8                                  | 1.0                           | 16.8                        |

\(^a\)Data on BMI is missing for 7.5% of women.

\(^b\)Data on smoking during pregnancy is missing for 6.9% of women.

\(^c\)Data on diabetes before pregnancy is missing for 3.5% of women.
within the same group allow risk assessment based on a balanced set of endpoints rather than a single parameter. This can be helpful both for clinicians and families, who may appreciate real-world data on obstetric performance at their site. In addition, evaluating the contribution of different groups enables a helicopter view to illustrate the proportion of each group in total outcome burden and thus help to direct interventions for improvement of obstetric care.

However, the Robson Ten Group Classification System has its limitations. The classification does not consider population characteristics, which hampers comparisons between units with different distribution of, for example, maternal age or body mass index (BMI). To allow transparency, interpretation and comparison, we presented the results stratified by Robson groups together with population characteristics.

Some examples of risk assessment and comparison based on our material follows. In our population, induction of labor compared with spontaneous onset did not entail change in OASIS rate in women with a singleton term pregnancy, cephalic presentation, without a previous CS. In women with a previous CS, there was a lower OASIS rate after induced labor than after spontaneous onset. In contrast to previous studies, this observation is based on attempted vaginal births after previous CS, not achieved vaginal births.\textsuperscript{27-30} The PPH rate was higher in term cephalic singleton births by prelabor CS than in spontaneous or induced labor for both nulliparous and multiparous women with unscarred uterus. Furthermore, spontaneous onset of labor was associated with lower proportions of Apgar score \textless 7 at 5 minutes compared with prelabor CS, which challenges the belief that prelabor CS is a shortcut to better neonatal health. Except for CS rate, the other outcomes for women with trial of labor after CS were quite similar to the outcomes for nulliparas. Moreover, all five outcomes were better for women with a previous CS and spontaneous onset of labor than for nulliparous women with induced labor. These results support that, with the patient selection according to current praxis, trial of labor after CS and even induction of such labor can be performed with a high success rate and safe outcomes for both mother and child, which may be valuable and reassuring information for women and obstetricians discussing this option, given contradictive findings and recommendations in the literature.\textsuperscript{31,32}

| Robson group | CS rate (%) | OVD rate (%) | OASIS rate (%) | PPH rate (%) | Rate of Apgar <7 at 5 min (%) |
|--------------|-------------|--------------|----------------|--------------|-------------------------------|
| 1            | 7.3         | 10.0         | 4.3            | 7.7          | 1.3                           |
| 2            | 32.3        | 10.7         | 3.8            | 12.6         | 2.4                           |
| 2a           | 22.6        | 12.3         | 4.3            | 12.5         | 2.4                           |
| 2b           | 100.0       | n/a          | n/a            | 13.4         | 2.3                           |
| 3            | 1.5         | 1.2          | 0.8            | 4.6          | 0.5                           |
| 4            | 17.2        | 1.7          | 0.8            | 8.3          | 1.1                           |
| 4a           | 4.3         | 1.9          | 0.9            | 7.1          | 1.0                           |
| 4b           | 100.0       | n/a          | n/a            | 15.7         | 1.9                           |
| 5            | 52.8        | 4.0          | 2.3            | 8.9          | 1.7                           |
| 5a           | 19.8        | 6.5          | 4.0            | 9.1          | 1.7                           |
| 5b           | 31.1        | 6.7          | 2.8            | 11.7         | 2.8                           |
| 5c           | 100.0       | n/a          | n/a            | 7.4          | 1.3                           |
| 6            | 92.9        | 0.3          | 0.2            | 6.3          | 3.5                           |
| 7            | 86.2        | 0.2          | 0.0            | 9.5          | 5.8                           |
| 8            | 53.2        | 6.1          | 0.4            | 21.3         | 4.4                           |
| 8a           | 41.2        | 5.9          | 0.4            | 17.3         | 5.8                           |
| 8b           | 20.7        | 12.0         | 0.7            | 22.8         | 2.3                           |
| 8c           | 100.0       | n/a          | n/a            | 23.5         | 5.1                           |
| 9            | 97.2        | 0.3          | 0.1            | 27.3         | 7.9                           |
| 10           | 26.9        | 3.0          | 0.8            | 7.6          | 6.7                           |
| 10a          | 10.7        | 3.7          | 1.0            | 5.6          | 5.0                           |
| 10b          | 17.5        | 3.8          | 0.9            | 7.1          | 4.6                           |
| 10c          | 100.0       | n/a          | n/a            | 14.1         | 14.0                          |
| Undefined    | 10.5        | 5.0          | 1.2            | 4.8          | 0.8                           |
| Total        | 17.4        | 5.1          | 2.2            | 7.6          | 1.6                           |

n/a = not applicable.
largest contributors and vice versa, as confirmed in our material. Notably, the largest contributors to the total rates of all outcomes except CS were women with singleton term cephalic pregnancies and unscarred uterus, nulliparous women with spontaneous and induced labor and multiparous women with spontaneous labor and unscarred uterus, which could be useful information for directing healthcare improvement measures. Both OASIS and PPH rates in Sweden were remarkably high, in line with previous observations, and can probably to some extent be explained by population characteristics and intrapartum factors, for example high birthweight, 

TABLE 4  Relative contribution of each Robson classification group to obstetric outcomes

| Robson group | Relative size of groups (%) | Contribution to CS rate (%) | Contribution to OVD rate (%) | Contribution to OASIS rate (%) | Contribution to PPH rate (%) | Contribution to the rate of Apgar score <7 at 5 min (%) |
|--------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|----------------------------|------------------------------------------------------|
| 1            | 27.5                        | 11.4                        | 54.1                        | 54.0                          | 27.9                       | 22.4                                                 |
| 2            | 10.8                        | 20.0                        | 22.8                        | 18.6                          | 17.9                       | 20.0                                                 |
| 2a           | 9.4                         | 12.2                        | 22.8                        | 18.6                          | 15.5                       | 14.6                                                 |
| 2b           | 1.4                         | 7.8                         | 0.0                         | 0.0                           | 2.4                        | 2.0                                                  |
| 3            | 33.8                        | 2.9                         | 8.0                         | 12.0                          | 20.6                       | 9.7                                                  |
| 4            | 9.5                         | 9.3                         | 3.1                         | 3.5                           | 10.4                       | 6.6                                                  |
| 4a           | 8.2                         | 2.0                         | 3.1                         | 3.2                           | 7.7                        | 5.0                                                  |
| 4b           | 1.3                         | 7.3                         | 0.0                         | 0.2                           | 2.6                        | 1.6                                                  |
| 5            | 9.5                         | 28.7                        | 7.5                         | 9.8                           | 11.1                       | 10.3                                                 |
| 5a           | 4.2                         | 4.8                         | 5.4                         | 7.7                           | 5.1                        | 4.5                                                  |
| 5b           | 1.6                         | 2.8                         | 2.1                         | 2.0                           | 2.5                        | 2.8                                                  |
| 5c           | 3.7                         | 21.1                        | 0.0                         | 0.0                           | 3.6                        | 3.0                                                  |
| 6            | 1.7                         | 9.3                         | 0.1                         | 0.2                           | 1.4                        | 3.8                                                  |
| 7            | 1.1                         | 5.3                         | 0.0                         | 0.0                           | 1.3                        | 3.8                                                  |
| 8            | 1.4                         | 4.2                         | 1.7                         | 0.2                           | 3.9                        | 7.7                                                  |
| 8a           | 0.5                         | 1.1                         | 0.5                         | 0.1                           | 1.0                        | 3.3                                                  |
| 8b           | 0.5                         | 0.6                         | 1.2                         | 0.2                           | 1.5                        | 1.4                                                  |
| 8c           | 0.5                         | 2.6                         | 0.0                         | 0.0                           | 1.4                        | 3.0                                                  |
| 9            | 0.3                         | 1.5                         | 0.0                         | 0.0                           | 1.0                        | 1.4                                                  |
| 10           | 4.2                         | 7.1                         | 2.5                         | 1.6                           | 4.2                        | 17.4                                                 |
| 10a          | 2.6                         | 1.6                         | 1.9                         | 1.2                           | 1.9                        | 8.1                                                  |
| 10b          | 0.8                         | 0.8                         | 0.6                         | 0.3                           | 0.7                        | 2.0                                                  |
| 10c          | 0.8                         | 4.7                         | 0.0                         | 0.0                           | 1.5                        | 7.3                                                  |
| Undefined    | 0.3                         | 0.2                         | 0.3                         | 0.2                           | 0.2                        | 0.2                                                  |
| Total        | 100.0                       | 100.0                       | 100.0                       | 100.0                         | 100.0                      | 100.0                                                 |

FIGURE 1  Relative contribution of each Robson classification group to obstetric outcomes. CS, cesarean section; OASIS, obstetric anal sphincter injury; OVD, operative vaginal delivery; PPH, postpartum hemorrhage
episiotomy use or management of second stage of labor.\textsuperscript{20,33–35} Regardless of cause, a reduction of these outcomes is desirable, preferably without raising CS and OVD rates too high and while maintaining the safety and wellbeing of newborns. Intuitively, one is tempted to start this betterment in the groups with the highest rates of the undesirable outcome. However, the improvement measures should also be focused on the largest contributors to the total amount of PPH and OASIS, namely, nulliparous women with spontaneous or induced labor and, notably, multiparous women with spontaneous labor and unscarred uterus. Moreover, these three common “uncomplicated” groups account for the largest contribution to the total amount of OVD and Apgar <7 at 5 minutes (but not CS). This is especially unanticipated for multiparous women without previous CS, with a singleton term cephalic pregnancy and spontaneous labor, which are generally considered the ultimate low-risk group.\textsuperscript{36} At the same time, some of the risk groups with high incidence of complications (for example multiple pregnancies) have low impact on total outcome due to a small group size. Thus, while assessing the data it is important to shift the focus depending on the objective, such as discussing risks and outcomes within a specific group of patients or allocating resources for improved quality of obstetric care.

This is a selection of observations that can be made based on our data. However, a more important result of this study is the suggested method of audit itself, allowing a multidimensional analysis based on a few readily available variables that are used and noted in clinical practice, which for the purpose of audit can be presented in a structured way. This is in line with those few previous studies that used a similar systematic approach.\textsuperscript{21,22} We believe that this method of audit with parallel evaluation of interconnected endpoints in all 10 groups of the same population, offers some insights that cannot be achieved by examining groups or outcomes one by one.

The strength of this study is the nationwide real-world data covering almost the entire population, collected prospectively with predefined variables and groups. Another strength is its versatile approach, with stratification according to the well-established Robson Ten Group Classification System for outcomes other than CS, which allows a systematic and multidimensional analysis and universal audit of obstetric care.

There are some limitations related to aggregated data collection. Some misclassification in groups and outcomes may occur. For example, there were a few cases of vaginal delivery and even OASIS in women allocated to prelabor CS groups (2b, 4b and 5c), indicating a few cases of probable misclassification. These cases were most likely vaginal deliveries in women with planned prelabor CS, and prelabor CS with previous OASIS as an indication, which is difficult to verify because of the lack of individual data in this study. However, the proportion of missing data was low and the accuracy of Swedish Pregnancy Register is deemed to be high.\textsuperscript{37} Furthermore, our aggregated data do not allow adjustment for confounding factors, which limits the possibility to assess causality. This makes conclusions based on the results rather hypothesis-generating than definitive. Finally, the Robson classification may not be optimal for assessing outcomes that are rare or specific for a particular subgroup of patients, such as uterine rupture, which is extremely rare in women with unscarred uterus, or necrotizing enterocolitis, which affects almost exclusively preterm infants.

In summary, we believe that our approach is of general interest and feasible in most settings. It is based on a few easily collectible variables. With a clear and comprehensive structure, it produces plenty of thoughtworthy results. Depending on focus of interest, several different aspects of obstetric care can be explored using the suggested method. Specific conclusions drawn from such analysis will depend on the population characteristics, management at the specific site, healthcare goals and obstetric culture. The results can be used for counseling of individual patients who are often interested in actual results at their labor ward, and for improvement of quality of care at hospital or national level. However, to improve quality of care in obstetrics, it is not enough to record and publish data using the Robson Ten Group Classification System. Clinically active midwives and obstetricians should be involved in structured recurring audits and continuous quality improvement based on teamwork.\textsuperscript{38} The natural result of such approach is the endeavor to improve, which comes from inside the labor wards rather than as extraneous pressure from governmental authorities. The Swedish model with integration of the Robson Ten Group Classification System in the medical record software and annual national meetings with focus on Robson-grouped CS have been central in achieving low CS rates. In a few clicks, CS rates by Robson group for an optional period of time can be visualized in the software used in the almost all labor wards in Sweden, which gives the possibility to follow selected CS rates continuously for each labor ward and thus discover, analyze and make improvements. These results are also reported each year to the Robson working and reference group within the Swedish Society of Obstetrics and Gynecology, which hosts an annual national meeting to analyze CS rate trends and discuss the reasons behind changes and differences between hospitals. Obstetrician and midwife representatives from all hospitals participate and contribute to sharing their experience and ideas and then bringing back these ideas to improve practice at their hospital.

We suggest that this concept could be taken further to include other outcomes that need improvement or are of interest. We believe that a balanced set of outcomes assessed in prespecified groups can help to increase overall safety of obstetric care by visualizing the effect of one measure aimed at one outcome, for example lowering the CS rate at the expense of other parameters of maternal or neonatal health. A Robson classification-based approach is also relevant for evaluating trends and their interrelations, studying women with special characteristics, for instance older or obese women, and for comparison between labor units or countries, at least those that have the possibility to collect data in a reliable way and the courage to be open with their results.

5 | CONCLUSION

To allow assessment and improvement of the quality of obstetric care, the interpretation of CS rates cannot be isolated from
other important obstetric endpoints. The Robson Ten Group Classification System provides a useful framework for analyzing not only CS rates but also rates of OVD, OASIS, PPH and Apgar score <7 at 5 minutes. Interpretation of these outcomes together allows a multidimensional approach to risk assessment based on real-world data, giving the possibility to identify high-risk groups, adjust existing preconceptions about risk levels, and find the largest contributors to the total burden of adverse events, which may be helpful for families and healthcare professionals. This format can also be used for inter-hospital and international comparisons, enabling systematic exploration beyond the single parameter of CS rates.

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CONFLICT OF INTEREST
None.

AUTHOR CONTRIBUTIONS
JS is responsible for the study idea, choice of methods, initial design, analysis and interpretation, and manuscript draft. LL is responsible for extraction and analyses of data from the Swedish Pregnancy Register. SBW is responsible for the final design, analysis and interpretation of results. All authors participated in discussion of study design, interpretation of results and manuscript revision. All authors have also approved of the final version of the manuscript.

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REFERENCES
1. Boatin AA, Cullinane F, Torloni MR, Betran AP. Audit and feedback using the Robson classification to reduce caesarean section rates: a systematic review. BJOG. 2018;125:36-42.
2. Macfarlane AJ, Blondel B, Mohangoo AD, et al. Wide differences in mode of delivery within Europe: risk-stratified analyses of aggregated routine data from the euro-Peristat study. BJOG. 2016;123:559-568.
3. Zeitlin J, Durox M, Macfarlane A, 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;128:1444-1453.
4. Senanayake H, Piccoli M, Valente EP, et al. Implementation of the WHO manual for Robson classification: an example from Sri Lanka using a local database for developing quality improvement recommendations. BMJ Open. 2019;9:e027317.
5. Robson MS. Can we reduce the caesarean section rate? Best Pract Res Clin Obstet Gynaecol. 2001;15:179-194.
6. Brennan DJ, Murphy M, Robson MS, O’Herlihy C. The singleton, cephalic, nulliparous woman after 36 weeks of gestation contributed to overall caesarean delivery rates. Obstet Gynecol. 2011;117:273-279.
7. WHO Statement on Caesarean Section Rates. 2015. Accessed 28th September 2021. Available from: http://apps.who.int/iris/bitstream/handle/10665/161442/WHO_RHR_15_02_eng.pdf;jsessionid=70F8EBE0599B39801D30535B3282490?sequence=1.
8. Nielsen TF, Olausson PO, Ingemarsson I. The cesarean section rate in Sweden: the end of the rise. Birth. 1994;21:34-38.
9. Seijmonsbergen-Schermers AE, van den Akker T, Rydahl E, et al. Variations in use of childbirth interventions in 13 high-income countries: a multinational cross-sectional study. PLoS Med. 2020;17:e1003103.
10. Escuriet R, White J, Beeckman K, et al. Assessing the performance of maternity care in Europe: a critical exploration of tools and indicators. BMC Health Serv Res. 2015;15:491.
11. Gibson K, Ballit JL. Cesarean delivery as a marker for obstetric quality. Clin Obstet Gynecol. 2015;58:211-216.
12. Singh R, Trivedi AN. Is the caesarean section rate a performance indicator of an obstetric unit? J Matern-Fetal Neonatal Med. 2011;24:204-207.
13. Rothwell PM. External validity of randomised controlled trials: “to whom do the results of this trial apply?”. Lancet. 2005;365:82-93.
14. Kotaska AJ, Klein MC, Liston RM. Epidural analgesia associated with low-dose oxytocin augmentation increases cesarean births: a critical look at the external validity of randomized trials. Am J Obstet Gynecol. 2006;194:809-814.
15. Tassis BMG, Ruggiero M, Ronchi A, et al. An hypothetical external validation of the ARRIVE trial in a European academic hospital. J Matern-Fetal Neonatal Med. 2020;1-8. doi:10.1080/14767058.2020.1849108.
16. Grobman WA, Rice MM, Reddy UM, et al. Labor induction versus expectant Management in Low-Risk Nulliparous Women. N Engl J Med. 2018;379:513-523.
17. Kruiseman NN, Ryan R, Naguleswaran K, Malone FD, Geary MP, Hehir MP. Novel use of the Robson ten Group classification system to categorize operative vaginal delivery. Am J Obstet Gynecol. 2019;220:5628-5629.
18. O’Leary BD, Kane DT, Aretz NK, Geary MP, Malone FD, Hehir MP. Use of the Robson ten Group classification system to categorise operative vaginal delivery. Aust N Z J Obstet Gynaecol. 2020;60:858-864.
19. Pyykonen A, Gissler M, Lehtonen L, Tapper AM. The rate of obstetric anal sphincter injuries in Finnish obstetric units as a patient safety indicator. Eur J Obstet Gynecol Reprod Biol. 2013;169:33-38.
20. Ladfors LV, Muraca GM, Zetterqvist J, Butwick A, Stephansson O. Postpartum haemorrhage trends in Sweden using the Robson 10-group classification system: a population-based cohort study. BJOG. 2022;129:562-571.
21. Rossen J, Lucovnik M, Eggebo TM, et al. A method to assess obstetric outcomes using the 10-group classification system: a quantitative descriptive study. BMJ Open. 2017;7:e016192.
22. Einarsdottir K, Sigurdardottir H, Bjarnadottir RI, Steingrimsdottir T, Knudsen E. The continuous audit of events and interventions 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;237:181-188.
23. Stephansson O, Petersson K, Bjork C, Conner P, Wikstrom AK. The Swedish pregnancy register - for quality of care improvement and research. Acta Obstet Gynecol Scand. 2018;97:466-476.
24. SFOG. Patientklassifikation enligt Robson. Accessed 28th September 2021. Available from: https://www.sfofg.se/media/296594/patientklassifikation_enligt_robson.pdf
26. Robson Classification: Implementation Manual. 2017. Accessed 28th September 2021. Available from: http://apps.who.int/iris/bitstream/handle/10665/259512/9789241513197-eng.pdf?sequence=1

27. D’Souza JC, Monga A, Tincello DG. Risk factors for obstetric anal sphincter injuries at vaginal birth after caesarean: a retrospective cohort study. *Int Urogynecol J*. 2019;30:1747-1753.

28. Hehir MP, Fitzpatrick M, Cassidy M, Murphy M, O’Herlihy C. Are women having a vaginal birth after a previous caesarean delivery at increased risk of anal sphincter injury? *BJOG*. 2014;121:1515-1520.

29. Räisänen S, Vehviläinen-Julkunen K, Cartwright R, Gissler M, Heinonen S. A prior cesarean section and incidence of obstetric anal sphincter injury. *Int Urogynecol J*. 2013;24:1331-1339.

30. Elvander C, Ahlberg M, Edqvist M, Stephansson O. Severe perineal trauma among women undergoing vaginal birth after caesarean delivery: a population-based cohort study. *Birth*. 2019;46:379-386.

31. Sentilhes L, Vayssière C, Beucher G, et al. Delivery for women with a previous cesarean: guidelines for clinical practice from the French College of Gynecologists and Obstetricians (CNGOF). *Eur J Obstet Gynecol Reprod Biol*. 2013;170:25-32.

32. ACOG Practice Bulletin No. 205: vaginal birth after cesarean delivery. *Obstet Gynecol*. 2019;133(2):e110-e127.

33. Blondel B, Alexander S, Bjarnadottir RI, et al. Variations in rates of severe perineal tears and episiotomies in 20 European countries: a study based on routine national data in euro-Peristat project. *Acta Obstet Gynecol Scand*. 2016;95:746-754.

34. Simic M, Cnattingius S, Petersson G, Sandstrom A, Stephansson O. Duration of second stage of labor and instrumental delivery as risk factors for severe perineal lacerations: population-based study. *BMC Pregnancy Childbirth*. 2017;17:72.

35. Loof E, Simic M, Ahlberg M, Snowden JM, Cheng YW, Stephansson O. Duration of second stage of labour at term and pushing time: risk factors for postpartum Haemorrhage. *Paediatr Perinat Epidemiol*. 2017;31:126-133.

36. Jardine J, Blotkamp A, Gurol-Urganci I, et al. Risk of complicated birth at term in nulliparous and multiparous women using routinely collected maternity data in England: cohort study. *BMJ*. 2020;371:m3377.

37. Ladfors LV, Muraca GM, Butwick A, Edgren G, Stephansson O. Accuracy of postpartum hemorrhage coding in the Swedish pregnancy register. *Acta Obstet Gynecol Scand*. 2021;100:322-330.

38. Hildebrand E, Nelson M, Blomberg M. Long-term effects of the nine-item list intervention on obstetric and neonatal outcomes in Robson group 1 - a time series study. *Acta Obstet Gynecol Scand*. 2021;100:154-161.

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