International Journal of Gynecology and Obstetrics 131 (2015) S23–S27

Contents lists available at ScienceDirect

International Journal of Gynecology and Obstetrics

journal homepage: www.elsevier.com/locate/ijgo

MATERNAL HEALTH

Quality assurance: The 10-Group Classification System (Robson classification), induction of labor, and cesarean delivery

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ARTICLE INFO

Keywords:
10-Group Classification System (TGCS)
Audit
Cesarean delivery
Induction of labor
Quality assurance
Robson classification

ABSTRACT

Quality assurance in labor and delivery is needed. The method must be simple and consistent, and be of universal value. It needs to be clinically relevant, robust, and prospective, and must incorporate epidemiological variables. The 10-Group Classification System (TGCS) is a simple method providing a common starting point for further detailed analysis within which all perinatal events and outcomes can be measured and compared. The system is demonstrated in the present paper using data for 2013 from the National Maternity Hospital in Dublin, Ireland. Interpretation of the classification can be easily taught. The standard table can provide much insight into the philosophy of care in the population of women studied and also provide information on data quality. With standardization of audit of events and outcomes, any differences in either sizes of groups, events or outcomes can be explained only by poor data collection, significant epidemiological variables, or differences in practice. In April 2015, WHO proposed that the TGCS (also known as the Robson classification) is used as a global standard for assessing, monitoring, and comparing cesarean delivery rates within and between healthcare facilities.

1. Introduction

One of the most important decisions in obstetrics is the decision to end a pregnancy before spontaneous labor has started. This may be for a maternal, or more commonly, a fetal reason and it may be by induction of labor or a pre-labor cesarean delivery. Likewise, if labor has started spontaneously or has been induced, it may sometimes be necessary to perform a cesarean delivery for either a fetal reason or lack of progress in labor. There is no standardized classification or methodology used for analyzing the outcome and the results of these decisions [1]. It is therefore difficult to compare results over time in one organization or between different organizations. There is often little consensus on the way we diagnose labor, the methods we use to accelerate labor, the way we monitor the fetus during labor, the indications and methods for inducing labor, or the indications for cesarean delivery.

Standardizing the way we analyze events and outcomes should be easier than standardizing the processes we use in labor and delivery. The aim of the present paper is to describe the 10-Group Classification System methodology (also known as the Robson classification) using 2013 data from the National Maternity Hospital, Dublin, Ireland [2].

2. The 10-Group Classification System

The National Maternity Hospital in Dublin is a tertiary referral hospital and one of the largest maternity hospitals in Europe. It produces an annual clinical report each year that is available for external scrutiny. Over the years, development of the methodology of audit of labor and delivery has been refined and now many other hospitals use the same principles. The National Maternity Hospital uses the 10-Group Classification System (TGCS) [3]. This system has been used extensively internationally to analyze cesarean deliveries [4,5], but it was originally designed so that all labor and delivery events and outcomes could be analyzed in the context of the different types of management that each unit may have. In addition, significant epidemiological variables could be incorporated either within the 10 groups or used to analyze the distribution of the 10 groups within different epidemiological subgroups.

The way the TGCS table is constructed and presented is important (Table 1). It is essential that there is a disciplined and standard way of interpreting the results [6]. Any particular group can only be interpreted individually in detail after first interpreting the different relative sizes of the other nine groups.

The groups are described in the first two columns. Ten groups were chosen to give some discrimination to the population; more than 10 would become difficult to remember. The different groups were chosen because of their clinical relevance and some were chosen to assist the determination of data quality. The order and relationships of the groups in the table are also important to enable rapid and easy interpretation of

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http://dx.doi.org/10.1016/j.ijgo.2015.04.026

Table 1
The Ten Group Classification system for cesarean deliveries, National Maternity Hospital, Ireland, 2013.

Group	Description	2013 2024/8755 (23.1%)	Size of group, %	Cesarean delivery rate in group, %	Contribution of each group (23.1%)
1	Nulliparous, single cephalic, ≥37 weeks, spontaneous labor	146/2040	23.3	7.1	1.7
2	Nulliparous, single cephalic, ≥37 weeks, induced or cesarean before labor	468/1305	14.9	35.9	5.3
3	Multiparous (excluding previous cesareans), single cephalic, ≥37 weeks, spontaneous labor	31/2564	29.3	1.2	0.4
4	Multiparous (excluding previous cesareans), single cephalic, ≥37 weeks, induced or cesarean before labor	130/944	10.8	13.8	1.5
5	Previous cesarean, single cephalic ≥37 weeks	683/1003	11.5	68.1	7.8
6	All nulliparous breeches	167/178	2.0	93.8	1.9
7	All multiparous breeches (including previous cesareans)	124/138	1.6	89.9	1.4
8	All multiple pregnancies (including previous cesareans)	130/198	2.3	65.7	1.5
9	All abnormal lies (including previous cesareans)	40/40	0.5	100	0.5
10	All single cephalic, ≤36 weeks (including previous cesareans)	105/345	3.9	30.4	1.2

the data. All groups could be further subdivided and some groups need to be amalgamated to provide more appropriate denominators depending on what events and outcomes are being analyzed. However, the more frequently the 10 groups are used internationally, the more useful they become as a common starting point for further analysis. The third column heading provides the numerator for the total number of cesarean deliveries and the denominator for the total number of women who delivered in the institution; the column contains the numerator and denominator for the number of cesarean deliveries and women who delivered, respectively, for each group. The numbers in each group should add up to the totals at the top. The percentage of women that cannot be classified gives a reflection of data quality.

The fourth column in the table gives the size of each group as a percentage and is calculated by the number of women in each group divided by the total number of women in the population. It is remarkable how consistent the sizes are in different populations and it therefore becomes relatively easy to either question the quality of the data or indeed identify unique populations.

The fifth column provides the cesarean delivery rate in each group by dividing the number of cesareans carried out in each group by the number of women in each group.

The sixth column provides the absolute contribution of each group to the overall cesarean delivery rate. This is calculated by dividing the number of cesarean deliveries in each group by the total number of women in the population. The contribution to the overall cesarean delivery rate is influenced by the cesarean delivery rate in each group and also the size of the group. The absolute (rather than relative) rate of contribution is recommended for use in Table 1. It is then easy to quickly interpret both the absolute and relative rates of contribution to the cesarean delivery rate.

Induction rates are most often described in terms of overall rates. This is misleading as not all women can or will potentially be induced. In addition, the incidence of induction of labor varies according to different groups of women as do the indications, methods of induction, implications of inductions, and outcomes. The most significant group in this context is group 2: nulliparous women at greater or equal to 37 weeks of gestation with a single cephalic pregnancy who are induced or have a pre-labor cesarean delivery [7]. The group of women who are induced is often referred to as group 2a. The appropriate denominator for the incidence of inductions in this group is all nulliparous women at greater or equal to 37 weeks of gestation with a single cephalic pregnancy—the total of groups 1 and 2 (Table 2). Group 2 is not split initially in the TGCS as, paradoxically, more information can be gleaned more quickly by keeping group 2 undivided.

Table 2
Total single cephalic nulliparous pregnancies at greater than or equal to 37 weeks of gestation (groups 1 and 2: n = 3345), 10 Group Classification System, National Maternity Hospital, Dublin, 2013.

Spontaneous labor	Induced labor	Pre-labor cesarean
61.0% (2040/3345)	35.7% (1195/3345)	3.3% (110/3345)

The same principles are applied to groups 3 and 4 to analyze induction of labor in all multiparous women at greater or equal to 37 weeks of gestation with a single cephalic pregnancy but no previous scar.

The only other groups of women that in practical terms are induced are relatively small, and because of this and their unique characteristics they should be audited completely separately. These include women in groups 5, 8, and 10.

2.1. Indications for inductions and cesarean deliveries

Indications for induction of labor, just like indications for cesarean deliveries, are becoming problematic in terms of audit as there seems to be an endless list developing, including no medical indication. These indications are often difficult to define, which leads to inconsistency in their use. The principles adopted are that some grouping of indication is required. Undoubtedly there is some overlap, but the indications are grouped according to the most significant one. Each group of indications for inductions can be analyzed in more detail, if required, to determine the particular specific indication.

The same principles are adopted for indications for pre-labor cesarean deliveries. Ideally, pre-labor cesarean deliveries should be divided into fetal, maternal, and no medical indication. However, these are difficult to define because of overlap and are therefore difficult to implement.

Finally, the indications for cesarean deliveries performed in spontaneous labor or after labor has been induced are described in Fig. 1 [1]. The principles of this classification are to distinguish between cesarean deliveries carried out for fetal reasons (no oxytocin) and cesarean deliveries carried out for dystocia (failure to progress). It uses the need for oxytocin as a distinguishing feature between fetal reasons and dystocia. It also describes the two common types of dystocic labors leading to cesarean delivery: labors progressing at less than 1 cm per hour (inefficient uterine action, IUA) and those that progress at more than 1 cm per hour initially and then subsequently fail to progress (efficient uterine action, EUA). IUA and EUA are subsequently subdivided.

For dystocia, the subdivision IUA, poor response (Dys/IUA/PR) is when oxytocin is prescribed and in theory reaches the maximum dose according to that delivery unit's guideline, but the labor fails to progress at more than 1 cm per hour. The subdivision IUA, inability to treat overcontracting uterus (Dys/IUA/ITT/OC) is when oxytocin is prescribed and is unable to achieve the maximum dose because the uterus over contracts. IUA, inability to treat, fetal intolerance (Dys/IUA/ITT/FI) is when oxytocin is prescribed and is unable to achieve the maximum dose because the fetus does not tolerate the oxytocin. Lastly IUA, no oxytocin (IUA/no oxytocin) is when there is poor progress (less than 1 cm per hour) but no oxytocin is prescribed for varying clinical reasons. Efficient uterine action (EUA) is divided into cephalopelvic disproportion/obstructed labor (EUA/CPD/obstruction) or malposition (EUA/malposition).

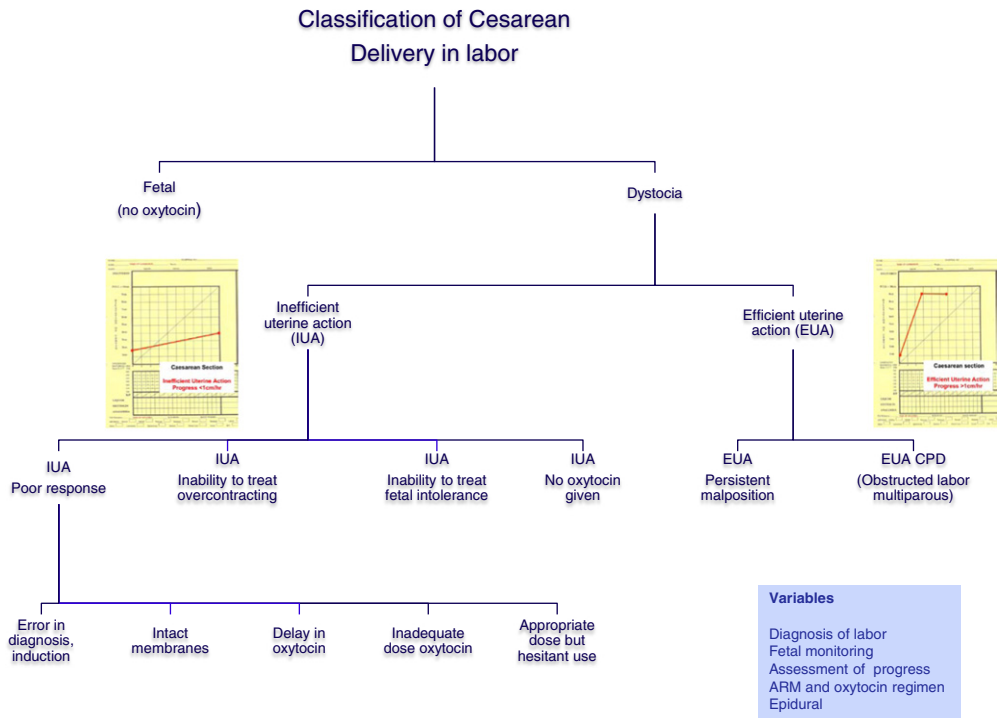

Fig. 1. Classification of the indications for cesarean deliveries performed among women in spontaneous labor or after induction of labor. A version of this figure appears in Murphy et al. [14].

The classification is constructed so that it can be used by any delivery unit irrespective of what definition they have for the diagnosis of labor, and also irrespective of how and when they accelerate (augment) labor using artificial rupture of membranes and oxytocin or the method of monitoring the fetus in labor. The concept behind this method of quality assurance is that, like the TGCS, the results will stimulate discussion regarding a unit's processes (management of labor) when comparing it with other units.

3. Example using National Maternity Hospital data for 2013

In 2013, 8755 women delivered 8954 neonates each weighing more than or equal to 500 g [1]. All of the women were classified according to the TGCS, shown in Table 1. This is the standard table used as the starting point for the classification system.

The distribution and size of the groups are reasonably standard. The raw numbers add up to the total, there are no missing data, and the size and cesarean delivery rate in group 9 signify good quality data.

The nulliparous and multiparous distribution is also reasonably standard, but there is a less than 2:1 ratio between the sizes of groups 1 and 2. This suggests a high incidence of induction and pre-labor cesarean deliveries in this cohort of women. In any given population, the ratio between the sizes of groups 3 and 4 is relatively higher than the ratio between groups 1 and 2.

The size of group 5 is appropriate relative to the overall cesarean delivery rate, as is the ratio between groups 6 and 7 and their combined sizes.

The size of group 8 at 2.3% is slightly higher than average, suggesting in vitro fertilization and replacement of more than one embryo or possibly a tertiary referral center.

The size of group 10 at 3.9% does not signify a particularly high rate of preterm delivery. With a cesarean delivery rate of 30.4%, there is neither a preponderance of spontaneous pre-term labor nor iatrogenic cesarean delivery.

The cesarean delivery rates in groups 1 and 3 are as low as any other international comparison [8].

The cesarean delivery rate in group 2 is high, suggesting a slightly high pre-labor cesarean delivery rate in addition to the actual increased size of group 2 noted previously. The group 4 cesarean delivery rate is pretty standard, reflecting a more balanced ratio between the induction of labor and pre-labor cesarean delivery rates.

The cesarean delivery rate in group 5 is higher than average at 68.1%. The high rates in groups 6 and 7 are pretty standard internationally. The cesarean delivery rate in group 8 is increasing steadily everywhere and again would not be very different to most if not all other delivery units. The rate of 100% in group 9 is what you would expect.

Overall, groups 1, 2, and 5 contribute to 14.8% in absolute terms to the total cesarean delivery rate of 23.1%. This makes up approximately two-thirds of the overall cesarean delivery rate, which is very standard.

Table 2 shows groups 1 and 2 subdivided into spontaneous, induced labor, and pre-labor cesarean deliveries. It is crucial to confirm these relative proportions by size before interpreting the cesarean delivery rates in groups 1 or 2a. The induction of labor rate is 35.7%, which is high.

Table 3 shows the indications for cesarean delivery in Group 1 classified by the descriptions given in Fig. 1. It shows a low cesarean delivery rate. The highest subgroup is IUA/inability to treat for fetal reasons, which suggests a more active approach to labor, probably an earlier and

Table 3
Indications for cesarean delivery in group 1 (single cephalic nulliparous pregnancies at greater than or equal to 37 weeks of gestation in spontaneous labour), 10 Group Classification System, National Maternity Hospital, Dublin, 2013.

Indication for cesarean delivery	No.(146/2040)	% (7.1)
1. Fetal reasons (no oxytocin)	25/2040	1.2
2. Dyst/IUA/ITT/FI	72/2040	3.5
3. Dyst/IUA/ITT/OC	30/2040	1.5
4. Dyst/IUA/PR	9/2040	0.4
5. Dyst (no oxytocin)	1/2040	0.05
6. Dyst/EUA/CPD/POP	9/2040	0.4

Abbreviations: Dyst, dystocia; IUA, inefficient uterine action; ITT, inability to treat; FI, fetal intolerance; OC, over contracting; PR, poor response; EUA, efficient uterine action; CPD, cephalopelvic disproportion; POP, persistent occipito posterior position.

Table 4
Events and outcomes in group 1 (single cephalic nulliparous pregnancies at greater than or equal to 37 weeks of gestation in spontaneous labour), 10 Group Classification System, National Maternity Hospital, Dublin, 2007–2013.

Group 1	2013 (%)		2012 (%)	2011 (%)	2010 (%)	2009 (%)	2008 (%)	2007 (%)
ARM to accelerate	1102/2040	54.0	52.8	53.6	52.9	52.4	53.5	54.5
Oxytocin	1100/2040	53.9	53.9	53.2	51.2	49.6	50.3	50.5
Epidural	1428/2040	70.0	73.0	73.7	68.6	66.4	63.9	64.7
Electronic monitoring	1790/2040	87.7	86.0	79.0	77.2	75.7	74.1	73.8
Fetal blood sample	424/2040	20.8	22.4	24.6	21.5	20.3	18.4	21.7
Vaginal operative delivery	479/2040	23.5	24.0	24.6	25.7	27.8	24.1	28.0
Apgar <7 at 5 min	14/2040	0.7	0.8	1.1	0.2	0.6	0.7	0.8
Cord pH <7.0	4/2040	0.2	0.3	0.5	0.2	0.3	0.3	0.6
Overall cesarean delivery	146/2040	7.2	9.3	7.4	7.5	7.8	7.2	6.1
Cesarean delivery at VE = 10	19/2040	0.9	1.2	1.4	1.3	1.4	1.2	1.1
Admitted to neonatal unit	349/2040	17.1	10.1	11.7	10.6	9.8	9.4	7.2
Episiotomy	936/2040	45.9	48.6	56.8	56.1	52.6	51.0	56.0
OASIS	55/2040	2.7	3.1	2.5	2.9	2.6	3.0	3.4
Duration of labor >12 h	59/2040	2.9	3.4	2.8	2.2	1.5	3.5	3.7
Neonatal weight ≥4.0 kg	296/2040	14.5	15.4	15.9	13.6	13.2	13.6	14.1
Maternal age ≥35 y	374/2040	18.3	16.7	16.7	14.5	14.0	13.8	14.2
Body mass index ≥30	146/2040	7.2	8.2	8.1	8.4	7.2	7.3	9.3
PPH >1000 ml	34/2040	1.7	1.3	1.0	0.4	0.5	0.2	0.4
HIE	1/2040	0.05	0.1	0.2	0.0	0.1	0.1	0.1
Blood transfusion	35/2040	1.7	1.5	-	-	-	-	-

Abbreviations: ARM, artificial rupture of membranes; VE, vaginal examination; OASIS, obstetric anal sphincter injuries; PPH, postpartum hemorrhage; HIE, hypoxic ischemic encephalopathy.

higher-dose oxytocin regimen; however, not necessarily a higher incidence of oxytocin.

Table 4 shows other events and outcomes in group 1 between 2007 and 2013. It is important to include these within all the different groups because no perinatal event should be interpreted on its own.

Table 5 shows the indications and grouping for induction of labor in nulliparous women at greater or equal to 37 weeks of gestation with a single cephalic pregnancy. Post-date pregnancy is defined as 42 weeks of gestation and greater. Finally, the indications for pre-labor cesarean deliveries are shown in Table 6.

Although not shown here, a similar analysis in groups 3 and 4 should be carried out and would show completely different results.

4. Discussion

The principles of perinatal audit are firstly that overall rates of events and outcomes are meaningless. Secondly, no perinatal event or outcome should be considered in isolation from other events, outcomes, and organizational issues. Thirdly, any classification of perinatal audit must be able to incorporate other variables that are important for interpreting the quality of perinatal care.

The purpose of the present paper is to demonstrate how the TGCS can be used as a common starting point to routinely audit induction of labor and cesarean deliveries [9]. However, other information including perinatal and maternal morbidity and mortality is required to ensure overall quality of care. The advantage of the TGCS is that it can be used to analyze all labor events and outcomes, while taking into account any significant epidemiological variables. The full benefit of the system will not be realized until it is used routinely by all labor and delivery units with a spectrum of different philosophies and management of care [10,11].

With standardization of perinatal audit of events and outcomes, any differences in either events or outcomes can be explained only by poor data collection, significant epidemiological variables, or differences in practice.

The challenges of implementing the system include explaining the philosophy of this new way of thinking and encouraging the importance of routine, standardized audit of each delivery unit's results. The emphasis in current obstetrics of practicing evidence-based medicine is appropriate, but continually collecting the evidence that we are providing quality care is as important and must be acknowledged and encouraged. Ideally this should result in an annual clinical report. Training will be required to best explain the methodology of collection, how to use the system to its full potential as well as how to interpret the results [6].

The benefits of the system are that it could be used to audit all perinatal outcome globally. This will allow all clinicians to learn from each other and on the basis of their results examine their practice. The sheer numbers of women in these databases will inevitably help to improve the quality of perinatal care.

Even though midwives and obstetricians in many countries have already made their choice, endorsement of the system both at national and international level is crucial. At the present time only the Society of Obstetricians and Gynaecologists of Canada [12] and WHO have formally endorsed the system [13]. In April 2015, WHO proposed that the system is used as a global standard for assessing, monitoring, and

Table 5
Indications for induction of labor in group 2a (single cephalic nulliparous pregnancies at greater than or equal to 37 weeks of gestation), 10 Group Classification System, National Maternity Hospital, Dublin, 2013.

Indication for induction of labor	No. (1195/3345)	% (35.7%)
Fetal reasons	310/3345	9.3
PET/hypertension	115/3345	3.4
Post-date pregnancy (≥42 wk)	253/3345	7.6
SROM	318/3345	9.5
Maternal reasons/pains	136/3345	4.1
Nonmedical reasons or dates <42 wk	63/3345	1.9

Abbreviations: PET, pre-eclamptic toxemia; SROM, spontaneous rupture of membranes.

Table 6
Indications for pre-labor cesarean delivery in group 2b (single cephalic nulliparous pregnancies at greater than or equal to 37 weeks of gestation), 10 Group Classification System, National Maternity Hospital, Dublin, 2013.

Indications for pre-labor cesarean delivery	No. (110/3345)	% (3.3)
Fetal reasons	43/3345	1.3%
PET/hypertension	9/3345	0.3%
APH/placenta previa/abruption	15/3345	0.5%
Maternal medical reason	29/3345	0.9%
No medical indication	14/3345	0.4%

Abbreviations: PET, pre-eclamptic toxemia; APH, antepartum hemorrhage.

comparing cesarean delivery rates within and between healthcare facilities. WHO will also develop guidelines to assist healthcare facilities adopt the system [13]. Professional organizations could, by formally endorsing the system, facilitate a truly global initiative.

Conflict of interest

Michael Robson developed the TGSC. The authors have no conflicts of interest.

References

[1] Robson MS. Labour ward audit. In: Creasy RK, editor. Management of Labour and Delivery. Oxford: Blackwell Science; 1997. p. 559–70.
[2] National Maternity Hospital. Annual Report 2013. http://www.nmh.ie/_fileupload/Annual%20Reports/FB%20NMH%20AR%2013%20English%20Final.pdf.
[3] Robson MS. Classification of caesarean sections. Fetal Matern Med Rev 2001;12(1):23–39.
[4] Torloni MR, Betran AP, Souza JP, Widmer M, Allen T, Gulmezoglu M, et al. Classifications for cesarean section: a systematic review. PLoS One 2011;6(1):e14566.
[5] Betran AP, Vindevoghel N, Souza JP, Gülmezoglu AM, Torloni MR. A systematic review of the Robson classification for caesarean section: what works, doesn't work and how to improve it. PLoS One 2014;9(6):e97769.
[6] Robson M, Hartigan L, Murphy M. Methods of achieving and maintaining an appropriate caesarean section rate. Best Pract Res Clin Obstet Gynaecol 2013;27(2):297–308.
[7] Brennan D, Murphy M, Robson M, O'Herlihy C. The singleton, cephalic, nulliparous woman after 36 weeks of gestation: contribution to overall cesarean delivery rates. Obstet Gynecol 2011;117(2 Pt 1):273–9.
[8] Brennan D, Robson M, Murphy M, O'Herlihy C. Comparative analysis of international cesarean delivery rates using 10-group classification identifies significant variation in spontaneous labor. Am J Obstet Gynecol 2009;201(3):308.e1–8.
[9] Robson M. The Ten Group Classification System (TGCS) – a common starting point for more detailed analysis. BJOG 2015;122(5):701.
[10] Vogel JP, Betran A, Gülmezoglu AM. Use of the Robson classification has improved understanding of caesarean section rates in France. BJOG 2015;122(5):700.
[11] Le Ray C, Blondel B, Prunet C, Khireddine I. Deneux-Tharaux, Goffinet F. Stabilising the caesarean rate: which target population? BJOG 2015;122(5):690–9.
[12] Farine D, Shepherd D. Classification of caesarean sections in Canada: the modified Robson criteria. J Obstet Gynaecol Can 2012;34(10):976–83.
[13] World Health Organization. WHO Statement on Caesarean Section Rates. WHO/RHR/15.02. Geneva: WHO; 2015. http://apps.who.int/iris/bitstream/10665/161442/1/WHO_RHR_15.02_eng.pdf?ua=1.
[14] Murphy M, Butler M, Coughlan B, Brennan D, O'Herlihy C, Robson M. Elevated amniotic fluid lactate predicts labor disorders and cesarean delivery in nulliparous women at term. Am J Obstet Gynecol 2015. http://dx.doi.org/10.1016/j.ajog.2015.06.035.