

The Study of Practice of the Four-Category Classification of Urgency of Cesarean Sections in the United Kingdom and Essential Inferences for Practice Improvement, Consistency and Reliability

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ABSTRACT

Objectives: Assess categorization of urgency of cesarean section in UK following NICE guidelines (2011).

Design: Cross-sectional survey of 80 obstetric registrars from different regions using a questionnaire to categorize 10 scenarios into four-category urgency of cesareans.

Results: Wide and statistically significant variations were seen with up to 25 -50% discordance for all categories, importantly affecting categories 1 and 2; a significant concern expressed by NICE in 2011. Almost all misquoted that decision-to-delivery-interval (DDI) for category-1 cesareans should be 30 minutes as opposed to "as soon as possible" (endeavour for 15 minutes) specified by NICE. Most registrars classed "conventional" fetal distress (no immediate threat to fetus) also into category-1, jumbled with very urgent (crash) cesareans. The Registrars commented they felt confused and dissatisfied with the current practice of categorization.

Conclusions: This study demonstrates that the four-category classification of cesareans is misapplied in actual practice. The main impetus behind this categorization was to remove the entrenched arbitrary 30minute DDI standard for cases of fetal distress by placing them in category-2. But the NICE recommendation of DDI of less than 75 minutes (level 3 evidence) for category-2 has unintended consequence making obstetricians feel uncomfortable/apprehensive and thereby class these as category-1. This also dilutes the recommended DDI for category-1 which should include only very urgent (crash) cesareans generally associated with acute hypoxic events like cord-prolapse. Although it would be possible to muddle along with a dysfunctional practice, this study identifies the need, areas and

essential solutions for improvement. The guideline-groups should recommend a more pragmatic range of DDI of 40-50 minutes or so (achievable without undue distress to mothers or excessive demands on service) for category-2 cesareans. Recommended optimal DDI should not be confused with more liberal audit standards as apparent in this study. Simply highlighting a continuous spectrum of time-frames to be individualised for each case doesn't seem to be working. More explicit and definitive guidance by giving multiple examples of each category with particular focus on cases of conventional fetal distress (category-2) as described in this paper seems necessary if satisfactory standardization of practice is to be achieved for meaningful data collection, audits and research.

Key words: Urgency of cesarean section, Cesarean section, Decision to delivery interval, NICE Cesarean section guidelines, Fetal distress

INTRODUCTION

Cesarean section (CS) is by far the commonest major operation performed worldwide. Deciding and communicating the urgency of cesareans is an everyday important practical issue for obstetricians and midwives. The traditional classification of CS into "elective" and "emergency" was found to be unsatisfactory for guidance and communication between the obstetric, anaesthetic and theatre teams. It has been more than a decade since British guideline groups [1,2] have implemented the four-category classification based on clinical definitions proposed by Lucas et al in 2000 [3]. The intention was to standardize clinical practice, improve

communication and thereby improve obstetric and anaesthetic outcomes as well as facilitate audit and

research into the optimal “decision-to-delivery-interval” (DDI) particularly for Category-1 and 2 CS. The National Institute for Clinical Excellence (NICE) noted a concern about lack of distinction between the category-1 and 2 CS in 2011 [4]. It also made new

recommendations for optimal DDI for category-1 and 2 CS and proposed slightly more liberal DDIs for audit purposes [4]. It is not known whether these guidelines have achieved these intended goals or indeed if there has been improvement in classification of urgency of CS over the years. This is important to know for drawing reliable conclusions from any audits and making

Table 1: The study questionnaire with the ten obstetric case scenarios.

	Hypothetical obstetric case scenarios	What Category of CS would you ascribe? (1,2,3, 4)	Maximum DDI (or range) based on NICE guidelines	Your ideal /preferable DDI
1	A Ventouse delivery is attempted in the delivery room on a primigravida for lack of progress. This fails with little descent of head. CTG continues to be normal. A decision is taken to perform a cesarean section.			
2	A woman at 36 weeks of gestation who is known to have grade III placenta praevia presents to labor ward with continuous slight trickling of blood. The total estimated blood loss is about 250ml at present. BP 130/80 and pulse 80/min. the CTG is normal. A decision is taken to perform a cesarean section.			
3	A primigravida has been booked for elective cesarean because off extended breech presentation. She is admitted with labor contractions, 4cm cervical dilatation and extended breech presentation. A decision is taken to perform a C section.			
4	A woman at 35 weeks gestation presents to delivery suite with abdominal pain and mild bleeding. Examination suggests abruption. Patient is haemodynamically stable. CTG shows persistent late (or atypical) decelerations.			
5	The CTG of a para-1 woman at 3 cm dilatation shows persistent late (or majority atypical variable decelerations) for more than half hour not responding to conservative measures. A decision is taken to perform a cesarean section.			
6	A primigravida is admitted at 34 weeks with severe pre-eclampsia (BP160/110, proteinuria 3+). She was previously under observation for mild preeclampsia and small for dates fetus. She has had mild headache which she has had off and on. A decision is taken to perform a caesarean section.			
7	A para 1 woman is admitted at 5 cm dilatation. She is booked to have elective CS because of a previous 3 rd degree tear which has left her with continuing problems of faecal incontinence.			
8	A primigravida is in labor and there is failure to progress with cervix remaining 6 cm dilated despite syntocinon augmentation. The CTG is normal. Decision is taken to perform a cesarean section.			
9	A multiparous woman is induced at 41+ weeks. The head is high. The CTG has been normal. A controlled artificial rupture of membranes at 3 cm dilatation is followed by cord prolapse.			
10	A primigravida is laboring at 41 weeks and the cervix is 7 cm dilated. The CTG shows persistent late (atypical) decelerations. Fetal blood sampling shows a pH of 7.18.			

Additional Comments (on the hypothetical case scenarios, 4-category classification or related matters). DDI= Decision to delivery interval

recommendations for future guidelines. There has been no systematic study of this categorization since 2009. Current study was undertaken to examine and analyse the current practice of four-category CS classification in British practice.

METHODS

The study was conducted in five National Health Service (NHS) maternity units (three University and two district general hospitals) in different regions of United Kingdom over three years (2014 – 2017) to capture a wide time-frame. Approval for the study was obtained from the Research and Ethics Committee of the author's Institute. The vast majority of CS of all categories are performed by obstetric specialist registrars (SpRs). Hence 80 SpRs from these maternity units were invited to participate in the study by post, email or personally with anonymization of data. The opportunistically random sampling technique was considered feasible and appropriate for this study. The SpRs were asked to complete a questionnaire requiring them to classify 10 theoretical obstetric scenarios (Table 1) into the four categories based on NICE (2011) guidelines [4] with which they were very familiar. This methodology was very similar to the one used by Lucas et al when they proposed this new classification in 2000 although the scenarios differed somewhat to suit the goals of this particular study [3]. They were also asked to comment on the expected maximum DDI for each scenario based on NICE (2011) guidelines [4] and also what DDI they would personally prefer. Space was provided to make additional comments regarding the classification or their own opinion and experience regarding its application in the current practice (Table 1).

RESULTS

The results are summarised in Table 2 and Figure 1. Thirty six percent of the SpRs were junior (year 1 - 3), while the majority (64%) were senior (year 4 -7) and all were very aware of the four-tier classification by NICE [4]. The results showed that despite this classification being first adopted by NICE way back in 2004 and reiterated in 2011 [1,4], the variation in categorization of CS urgency by SpRs was surprisingly very wide indeed. Similar variation was also observed in expected and preferred DDI for the ten case scenarios (Table 2). The results were very similar for junior and senior SpRs.

The medians and ranges for DDI are shown in Table 2. The implications of these DDIs for a few scenarios were particularly interesting as discussed later. The design of this study was not "quantitative" i.e. it did not depend primarily on generating large amounts of quantitative data. But crucially some clinically important hypotheses were translated into case scenarios which were submitted the SpRs to analyse their approach based on their current practice. Hence, 80 participants were felt to suffice drawing valid conclusions and higher numbers would not have made a difference. The deviation from NICE guidelines was statistically significant but more importantly quite wide to be clinically acceptable (Table 2). Very few SpRs took the opportunity to make additional comments about the categorization of urgency itself but many commented about the practical application. The comments were as follows,

1. I am very confused by how these categories are used in practice which also varies in different hospitals in UK.
2. I do not agree with how the categories are interpreted currently but have to follow what majority are doing.
3. I very much believe that we need a fifth category, with Category 4 for women who need to be delivered within the next couple of days or at the next "in-hours" opportunity and Category 5 for truly pre-booked elective CS.
4. I have never agreed with the classification of categories as it doesn't directly relay a decision to delivery interval. I believe a designated time should be stated with each scenario, it is less confusing.
5. I am concerned that any sense of urgency disappears when the theatre and anaesthesia teams are given a target of 75 minutes as acceptable DDI (category-2).

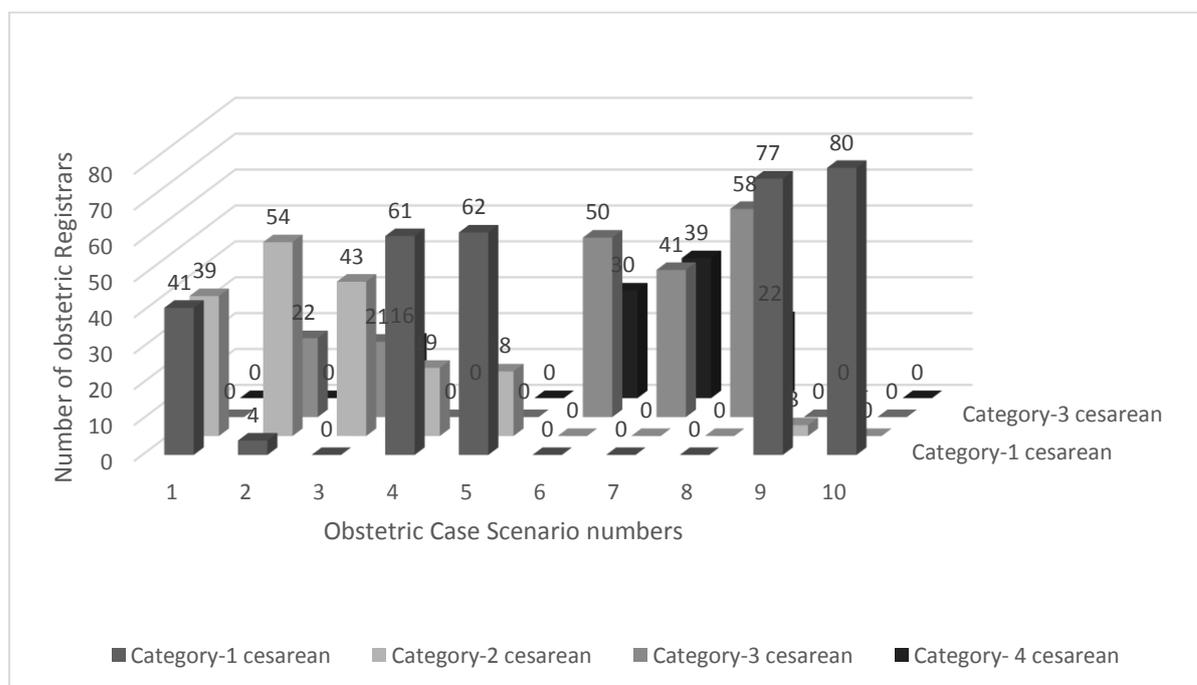
The relative paucity of additional individual comments by SpRs is difficult to understand but may indicate that they attach less importance to the actual categorization of urgency but rely more on direct comprehensive communication with the team members, a very desirable practice. A few SpRs from some hospitals expressed concern that they felt uncomfortable with the time spent for World Health Organisation (WHO) checklist (time out) [5] before skin incision during crash CS e.g. for cord prolapse. WHO actually states that the Checklist should strive to be brief, concise and focussed, addressing issues that are most critical and not adequately checked by other safety mechanisms [5]. Some SpRs felt that the

Table 2: The four-category classification of urgency of cesarean sections (CS) by 80 obstetric Specialist Registrars (SpRs) for the ten obstetric case scenarios and their suggestions about decision to delivery intervals (DDI).

Case Scenario Number	Category 1 cesarean	Category 2 cesarean	Category 3 cesarean	Category 4 cesarean	Proportion (95% confidence interval; Wilson score) of divergent answers from NICE guidelines	Maximum DDI Median (Range) min	Preferable DDI Median (Range) min
1	41 (51%)	39 (49%)	0	0	51 (40-62)%	30 (30 - 90)	30 (15 - 30)
2	4 (5%)	54 (67%)	22 (27%)	0	72 (62-81)%	75 (50 - 360)	45 (30 - 60)
3	0	43 (54%)	21 (26%)	16 (20%)	71 (63-82)%	90 (50 - 240)	60 (30 - 120)
4	61 (76%)	19 (24%)	0	0	24 (16-34)%	30 (20 - 60)	15 (ASAP - 30)
5	62 (78%)	18 (22%)	0	0	78 (67-85)%	30 (30 - 90)	30 (ASAP - 60)
6	0	0	50 (62%)	30 (38%)	38 (28-48)%	180 (50 - ND)	75 (ASAP - ND)
7	0	0	41 (51%)	39 (49%)	49 (38-69)%	90 (50 - ND)	60 (ASAP - 120)
8	0	0	58 (72%)	22 (28%)	28 (19-38)%	75 (50 - 240)	60 (ASAP - 90)
9	77 (96%)	3 (4%)	0	0	4(1-10)%	30 (20 - 30)	20 (ASAP - 60)
10	80 (100%)	0	0	0	100 (95-100) % (?) See text	30 (20 - 30)	20 (ASAP - 30)

Composite Wilson score (413 answers out of 800 deviated from NICE guidance) = 52 (48-55) %; [p<5% for all rows]

Figure 1: Cesarean section urgency categorization of 10 obstetric case scenarios by 80 Specialist Registrars



checklist before the skin incision should be very short indeed for the most urgent CS (category-1) which seems possible without compromising patient safety.

DISCUSSION

The introduction of a four-category classification of urgency of CS in 2000 [3] was thought to be an important advance because the previous 2-tier classification into "elective" and emergency was clearly suboptimal. NICE adopted the four-category classification in 2004 with minor modifications in 2009 and 2011[1,2]. Kinsella and Scrutton reported a wide variation in classification urgency of CS in 2009 using 10 hypothetical case scenarios [6]. It would be desirable that there would be improved consistency after more than a decade and particularly after the revised NICE guidelines of 2011[4]. The current study was conducted to test this premise using a similar methodology (Table 1) used by the previous two studies [3,6]. Unfortunately, this study again shows that there is even more wide variation in the four-category classification by SpRs who perform the vast majority of emergency and elective CS in the UK. Given the subjective nature of the clinical decision making, small variations in categorization of the ten case scenarios would be acceptable. However, 25 -50% variation in many case scenarios (Table 2) seems dysfunctional and demands a critical appraisal. The additional comments by the SpRs also reveal significant confusion and dissatisfaction with the current practice.

The main impetus behind this four-category classification was to distinguish the cases which need very urgent delivery which are mainly the cases of obstetric sentinel hypoxic events like cord prolapse, placental abruption, hemorrhage from vasa praevia or non-recovering fetal bradycardia etc. These cases were previously referred to as "crash CS" and are best delivered as soon as possible ideally within 15 minutes or so.

The other major impetus was to move away from the arbitrary "30minute DDI standard" which had become entrenched whenever cases were labelled as "fetal distress". This has sometimes been described as obstetrician's distress [7]. The four-category classification is essentially clinical and not primarily "DDI timing" based [1,2,3]. The inferences regarding DDI timing are secondary and would vary to some extent depending on individual case characteristics and may sometimes be best defined in the form of time range. The optimum DDI as a continuous spectrum of urgency has been highlighted by national guidelines [2]. It is also clear that four categories should be more than enough to incorporate all types of cases and any

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temptation to increase the number of categories would be more confusing and hence misplaced. A "perfect" structure or complete consistency of categorization is not realistic. Also, there is no dearth of individual opinions regarding the interpretation of different categories of urgency. Hence, this structured study attempts to explore what is the perception of the key clinicians actually implementing the categorization. Based on the SpRs' comments and by critical analysis of their responses to the 10 obstetric scenarios (Table 1, 2), following conclusions can be drawn which should assist to improve consistency. These conclusions would also inform future guidelines to come up with additional and clearer recommendations.

Case scenario-1: This is somewhat a trick scenario. Although it could be argued that there is no obvious evidence of any fetal or maternal compromise, most obstetricians would presume some fetal compromise and a quick delivery advisable. Hence, category-2 CS seems an appropriate choice but DDI of within 30 minutes should be aimed for using flexibility.

Case Scenario-2: In this case although there is mild continuing antepartum hemorrhage (APH), there is no maternal or fetal compromise currently but could arise in future. This case would fall in category-3. Delivery could be accomplished in a few hours depending of fetomaternal condition and other workload in the delivery unit.

Case scenario-3: In this case there is no fetal or maternal compromise at present (category-3). Fetal compromise could arise if breech delivery ensues. Hence, the DDI should be individualised based on time required for adequate preoperative preparation and on how fast the labor is progressing.

Case scenario-4: With pathological fetal heart rate (FHR) decelerations and clinical evidence of abruption, there would be a perceived immediate threat of fetal compromise. This case is best classed as category-1.

Case scenario-5: This is a case of usual / typical fetal distress where there is unlikely to be an "immediate" threat to fetal wellbeing. Only if labor is allowed to continue with further procrastination then fetal pH may fall below 7.05 which is then associated with some chance of resultant hypoxic morbidity [8,9,10] which should of course be prevented. Unless the cardiotocograph (CTG) is rapidly worsening, this case would fall in category-2. Many SpRs classed this case a category-1 because they felt uncomfortable with the recommendation of DDI of 75 minutes for category-2 [3].

Case scenario- 6: Most SpRs quite rightly placed this case in category-3.

Case scenario-7: This case is best placed in category-3. It is surprising that 49% of SpRs placed this case in category-4.

Case scenario-8: This case is again best placed in category-3. It is surprising that 25% of the SpRs wrongly classed this case as category-4. However, some overlap in classification into category 3 and 4 seen in these scenarios is generally of no practical importance.

Case scenario-9: The vast majority of SpRs placed this case of cord prolapse quite rightly category-1. However, many of them wrongly concluded that the recommended DDI is 30 minutes confusing it with the audit standard (NICE, 2011) [4].

Case scenario-10: This is again a usual / typical case of fetal distress. "Numbers" tend to make a strong impression / impact on human perception; and create a feeling of (sometimes misplaced) authenticity. The numerical figure of pH 7.18 on fetal blood sampling (FBS) engenders a sense of "certainty" and which had a strong influence on most SpRs, who hence placed this case into category-1. They may have also tended to play safe in this case because of the concern with the recommendation DDI of 75 minutes for category-2. However, it is well known from good quality studies that there is no fetal hypoxic morbidity above the fetal pH of 7.05 [8,9] and in most cases the pH would not be falling rapidly and may even improve with conservative management while preparing for CS. Another prominent study of 16,060 babies suggested that the lower end of "normal" umbilical artery pH is 7.10 [10]. The very fact that the case is suitable for FBS tends to indicate that the fetal condition (CTG) is relatively stable with a viable option of further waiting for a vaginal delivery. The procedure of FBS itself could take 15-30 minutes. Should such cases be lumped with "crash cesareans" like cord prolapse or non-recovering fetal bradycardia? Provided there is no associated acute hypoxic sentinel event or rapidly deteriorating CTG, it could be argued that this case should not be classed as category-1. It seems important to differentiate these cases from those requiring DDI of preferably <15 mins (crash or category-1 CS). The DDI would depend on the assessment of the degree and worsening of fetal distress based on CTG changes. In most case a DDI of around 30-50 minutes would be safe and achievable without unnecessary stress to the women. Notwithstanding, many local individual hospital guidelines play safe by including fetal blood sampling pH below 7.20 as an indication for category-1 CS (but recommend DDI of 30 minutes). This particular scenario remains controversial and needs to be more

definitively and pragmatically addressed by the guideline-groups to give more clarity to clinicians.

Main Inferences

The main inferences from the findings of this study can be summarised as below.

Category-1: Immediate threat to life of woman or fetus

This category is best reserved for most urgent cases (generally associated with an acute sentinel hypoxic event) which were previously referred to as crash CS. Perimortem CS would also fall in this category but is extremely rare. NICE [1,4] clearly recommends that in category-1 cases the delivery should be accomplished as soon as possible and ideally within 15 minutes of making the decision. However, care need to be taken not to compromise mother's wellbeing and sometimes 15 minute DDI target may not be achieved. Probably for this reason an audit standard of 30 minutes has been proposed by NICE [4]. But this has caused some confusion amongst the obstetricians. Hence, guidelines should clarify that only for audit purposes a DDI of more than 30 minutes would be considered unsatisfactory but the aim should be to deliver category-1 cases a lot more urgently.

Category-2: Maternal of fetal compromise not immediately life threatening

Most cases of the so called "fetal distress" (FHR abnormalities) would fall into this category. There is some agreement on this [11] but the practical conflict and apprehension created by the "75minute DDI recommendation" has not been hitherto recognised. It is important to remember that the diagnosis of fetal distress is very imprecise and most cases there is no immediate threat of fetal morbidity which could arise with procrastination or if labor allowed to continue for much longer. NICE [4] recommends that category-2 CS cases should be delivered within 75 minutes. The rationale behind the recommendation is that in a large retrospective study the fetal outcome did not deteriorate until the delivery was delayed beyond 75 minutes [12]. This study also showed that the fetal outcome was no better even when the delivery was accomplished before 30 minutes. How does one square this circle? In fact these findings demonstrate the limitations of a retrospective study. The DDI closer to 75 minutes may have been in cases perceived to be of doubtful fetal distress or the CTG could have normalised during preparation for CS. Conversely, the cases delivered within 30 minutes may be of more serious fetal distress and hence the lack of better outcome. Thus, it is possible to argue that the recommendation of DDI should not be primarily and entirely on findings of retrospective studies (level-3

evidence). Sole emphasis on fickle retrospective numerical or quantitative data without discerning of logistical practicalities may not be a good evidence based approach. The recommendation of 75 minutes DDI for category-2 seems to have caused particular problems to obstetricians as revealed in the current study. Most obstetricians felt very uncomfortable / apprehensive with DDI of 75 minutes when they had made a diagnosis of fetal distress. Hence to overcome this problem many junior and senior obstetricians tended to place cases of commonly diagnosed fetal distress into category-1. This obviously defeats the objective of moving away from the entrenched arbitrary "30minute DDI standard" thus perpetuating the "obstetrician's distress". It has been well proven that the DDI of 30 minutes for cases of conventional fetal distress is unachievable in the UK, but most of these cases were delivered in 30 -40 minutes [13]. Hence, a more pragmatic and discerning DDI recommendation for category-2 CS would be a time-frame which can be reasonably achieved without causing undue distress to mother and unnecessary pressure on the medical resources. Thus, it would be much better for guideline groups to recommend DDI in the form of a range of 40-50 minutes or so for category-2 CS rather than the current figure of 75 minutes derived from a retrospective study.

Category-3: No maternal or fetal compromise, but early delivery needed

Cases in category-3 would include non-progress of labor, breech presentation in labor, cases for elective CS presenting with labor or ruptured membranes, continuing antepartum hemorrhage (APH) and severe pre-eclampsia requiring early delivery etc. Many of these cases can be delivered in a few hours' time when the situation is stabilised and any other more emergency cases have been dealt with. However, if the labor is progressing rapidly then some of these cases may have to be delivered sooner than later. Hence any time-frame will depend on individual circumstances any definite DDI recommendation seems unnecessary and impractical.

Category-4: Delivery time to suit woman and staff

The category-4 would include the standard elective CS and generally considered to include cases where CS can be planned at least 24 hours in advance as a rough rule.

CONCLUSIONS

This study showed a wide very variation (25 -50%) in categorization of urgency of CS by SpRs in UK more than a decade after its adoption. The most variation was apparent in differentiation of category 1 and 2 CS, a concern expressed by NICE in 2011 [4],

which of course has important clinical implications. Many obstetricians seem unaware that this classification of urgency of CS is primarily clinical and not timing-based. Guideline-groups need to emphasise that only rough range of DDI can be prescribed for different categories of CS and it is up to the clinicians to communicate the optimal DDI in individual cases to the other theatre and anaesthetic team members. Guideline-groups also need to be even more explicit that the audit standards of DDI do not necessarily equate to optimum DDI in individual cases. The majority of cases of typical "fetal distress" would fall in category-2, enabling a move away from the entrenched but disproven arbitrary 30minute DDI target for these cases. But the recommended DDI of less than 75 minutes for category-2 CS based on level 3 evidence had particular concerns and unintended consequences for obstetricians and a reform in this area recommending a range of DDI of 40-50 minutes (achievable without undue distress to mothers and obstetric teams) would be desirable. It needs to be emphasised that category-1 represents the previously termed "crash CS" and preferred DDI is "as soon as possible", ideally less than 15 minutes and not 30 minutes, although the latter could serve as a useful audit measure. This message by NICE [4] is currently lost mainly because of admixture of category 1 and 2 cases by the clinicians. This clinical classification is for guidance and there is a spectrum of optimal DDI in each category which will depend on clinician's judgement. But a good degree of concordance is highly desirable for any clinical usefulness. Moreover, any studies /audits about outcome measures in different categories of CS based on data collection over the last decade is very likely to be devoid of any meaning because of the major variation in classification as shown by this study. Time has come for the guideline groups to be more explicit and definitive about the clinical categorization of urgency of CS giving specific examples in each category as described in this paper with a particular focus on cases of typical fetal distress (category-2) if any meaningful standardization of practice is to be achieved.

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