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► To cite this version:

Marine Le Mitouard, Laurent Gaucher, Cyril Huissoud, Pascal Gaucherand, René-Charles Rudigoz, et al.. Decision-delivery intervals: Impact of a colour code protocol for emergency caesareans. European Journal of Obstetrics & Gynecology and Reproductive Biology, 2020, 246, pp.29 - 34. 10.1016/j.ejogrb.2019.12.027 . hal-03489768

HAL Id: hal-03489768

<https://hal.science/hal-03489768>

Submitted on 21 Jul 2022

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1 Decision-delivery intervals: impact of a colour code
2 protocol for emergency caesareans

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Introduction

Obstetrics is a specialty that requires great reactivity to enable rapid analysis of emergency situations that threaten the prognosis for maternal and/or fetal survival and to organise their management. In cases of perinatal anoxia, studies have shown that rapid birth does not systematically prevent the onset of ischaemic encephalopathy, but that a decision-delivery interval (DDI) of 20 minutes or less reduces neonatal morbidity (1,2).

Nonetheless, there is no international consensus concerning the intervals within which emergency and extreme emergency caesareans must be performed. In 2012, the American College of Obstetrics and Gynecology suggested that the interval between the decision to perform a caesarean and the incision should "better integrate the maternal and fetal risks and advantages by adaptation to local circumstances and logistics" but did not propose any specific interval (3). In Great Britain, a delay of 75 minutes is recommended for emergency caesareans, reduced to 30 minutes in extreme emergencies (4). A shorter 20-minute delay is recommended in Germany (5), while no specific guidelines exist in France. Numerous studies have demonstrated that adherence to the "30-minute rule" is often difficult in emergencies, extreme or not (6).

The establishment of communication tools and specific protocols organising the management of these emergency or extreme emergency caesareans makes it possible to reduce the DDI (7,8). Nonetheless, the impact of the organisation of maternity units (for example, level of care and organisation of coverage and on-call policies) has been studied very little. In 2007, a multicentre study in the 26 maternity units of a French perinatal network showed that DDIs varied significantly as a function of the maternity ward level and organisation (9). Nonetheless it found no association with neonatal outcome. All network teams then received feedback that specified the areas for improvement. The principal objective of this work was to assess the impact 10 years later of the passive dissemination of a "colour code" protocol set up to reduce the DDI within these 26 maternity units in the same perinatal network.

57 Material and methods

58
59 This observational study was conducted in the Auvergne-Rhône-Alpes region
60 in the AURORE perinatal network (**A**ssociation des **U**tilisateurs
61 du **R**éseau **O**bstétrico-pédiatrique **R**Egional), in which around 44,000 deliveries take
62 place each year. It brings together 26 public and private maternity units: 14 level 1,
63 10 level 2, and 2 level 3. In maternity units with fewer than 1500 deliveries per year,
64 obstetricians and anaesthesiologists must respond "within the time compatible with
65 safety imperatives"; they are not required to be onsite 24/7 but can be on-call offsite.
66 Inversely, both must be present onsite 24/7 in hospitals with more than 1500
67 deliveries per year (10). Moreover, above 2000 deliveries annually, the
68 anaesthesiologist must be on call exclusively for obstetrics patients (11).

69 Between 2003 and 2017, a new communication tool called "colour code" was
70 set up in the various maternities of the network. The purpose of this protocol is to
71 optimize the organisation of the team involved in performing an emergency
72 caesarean section by setting a precise target time limit according to the indication of
73 the caesarean, quickly communicating this objective to the whole team and giving to
74 each one a role in the process (the protocol is included as the Appendix).

75 As in 2007 (n=447 cases observed) (9), each maternity ward was supposed to
76 prospectively include 20 consecutive cases of caesareans performed as code orange
77 emergencies or code red extreme emergencies between October 1, 2017, and April
78 30, 2018, regardless of type of pregnancy or fetal presentation. The date inclusion
79 ended depended on the volume of activity of each maternity ward. The total number
80 of expected cases was 520.

81 The classification of caesareans as emergencies or extreme emergencies was
82 determined by the senior obstetrician available according to the clinical situation (12)
83 A code red was announced on determination of an immediate threat to the survival of
84 mother or fetus, with the DDI objective set at less than 15 minutes; a code orange
85 was called for short-term threats to maternal or fetal prognosis, with a target DDI of
86 less than 30 minutes. A code green, which involved no short-term threat, has been
87 described but was not the object in this study.

88 When the obstetrician decided a caesarean section was indicated, the time of
89 the decision was announced and noted in the medical file. Then, DDI was calculated

90 in relation to the time of delivery. The collect of data has been realized in each
91 maternity by its health manager who prospectively completed a form with the different
92 times as well as maternal and fetal data.

93 The principal endpoint was the DDI observed in 2017 for each colour code,
94 compared with that observed in 2007, before establishment of the colour code
95 protocol. The DDIs for code red caesareans observed in 2017 were compared to
96 those for extreme emergency caesareans in 2007; similarly, the 2017 code orange
97 caesareans were compared with the 2007 urgent caesareans.

98 The secondary outcome measures compared, according to the maternity unit
99 level (1, 2 or 3) and organisation (physicians on-call offsite or onsite), the DDI, the
100 percentage of cases adhering to the recommended intervals, the individual maternal
101 and neonatal characteristics as well as rates of non-severe postoperative postpartum
102 haemorrhages (PPH) (> 500 mL) and complications and of severe PPH (blood loss >
103 1000 mL) and complications (surgical revision, infection or bladder wound). To
104 assess neonatal status, we examined the number of newborns with a 5-minute Apgar
105 score ≤ 3 , a pH < 7, resuscitation or intensive care procedures, and early deaths.

106 The qualitative variables were expressed as numbers and percentages, and
107 the quantitative variables as medians with their interquartile range [IQR]. The
108 qualitative variables were compared with the Chi² test or, when the theoretical
109 number of individuals was less than 5, Fisher's exact test. The quantitative variables
110 were compared by the Wilcoxon-Mann-Whitney non-parametric test when there were
111 two samples or the Kruskal-Wallis test for comparisons of more than two samples.
112 The intervals were compared with a Wilcoxon rank sum test. Significance was set at
113 a p-value of 0.05. We used XLSTAT®2018 (13) and R3.3.2® (14) statistical software
114 for the analyses.

115 The data were collected, anonymised and analysed after approval by the
116 ethics committee of the Hospices civils de Lyon. The data are preserved on the
117 AURORE network server.

118 Results

119

120 All 26 maternity units of the AURORE network agreed to participate in this
121 study, which included 478 cases of the 520 expected cases (91.9%): 355 emergency
122 code orange caesareans and 123 code red extreme emergency caesareans. This
123 shortfall is due to some maternity units without enough activity to enable the
124 recruitment of 20 cases over the 6-month study period.

125 These results were compared to those of the 447 urgent or very urgent cases
126 of caesarean section included in 2007 in the 31 maternity units of the network at the
127 time. Maternal and neonatal characteristics by each period are shown in table 1. In
128 2017, patients are older ($p=0,001$) and the proportion of previous caesarean section
129 is higher ($p=0,003$) than in 2007.

130 The characteristics of the women included, except for parity, did not vary
131 significantly between the maternity units of different levels, and the postpartum
132 complication rates were close or identical. We did not observe a significant difference
133 for median gestational age at birth or for the global rate of preterm delivery < 37
134 weeks of gestation (weeks). Nonetheless, the rates of very preterm birth (< 32
135 weeks) and extremely preterm birth (< 28 weeks) were significantly higher in the level
136 3 maternity units (respectively $p=0.001$ and $p=0.005$) (Table 2). Table 3 summarises
137 the principal indications for code orange and code red caesareans by the maternity
138 ward level.

139

140 Decision-delivery intervals

141 Compared with 2007, the DDIs were significantly lower in 2017 for the code
142 orange and code red caesareans, regardless of the maternity unit level ($p < 0.0001$)
143 except for code orange caesareans in level 3 units ($p=0.35$). In 2017, the median DDI
144 varied from 18 to 36 minutes for the code orange emergency caesareans and from
145 10 to 19.5 minutes for the code red extremely emergency caesareans (Table 4).

146 In 2017, all code red caesareans were performed in less than 15 minutes in level 3
147 maternity units compared with 73% ($p=0.039$) in 2007 (Table 5). The adherence to
148 the protocol DDI in the level 1 and 2 maternity units was significantly better in 2017
149 than in 2007. Indeed, fewer than 20% of the caesareans in the 2007 study period
150 were performed in less than 15 minutes in level 1 and 2 maternity units. Today, this is

151 the case for 83% of these caesareans in level 2 units ($p < 0.001$) and 36% in level 1
152 ($p=0.01$).

153 This significant improvement in the proportion of emergency caesareans adhering
154 to the protocol also concerned the code orange caesareans. In 2017, code orange
155 caesareans were performed in less than 30 minutes in 96% of cases in level 3 units,
156 67% in level 2, and 33% in level 1, compared respectively with 67% ($p=0.015$), 25%
157 ($p < 0.0001$) and 16% ($p=0.0003$) in 2007.

158 Code red caesareans had similar DDIs in level 2 and 3 maternity units and were
159 both significantly shorter than in level 1 units. Level 3 units had significantly shorter
160 DDIs for code orange caesareans than either level 1 or level 2 maternity units, as did
161 level 2 units compared with level 1 ($p < 0.0001$).

162 When the team was on-call offsite, the code red and code orange caesareans
163 were performed significantly less often within, respectively, 15 and 30 minutes (fewer
164 than 20% vs. 64% and 55% respectively, $p < 0.0001$).

165

166 Neonatal outcome

167 Neonatal status did not differ significantly accordingly to expected DDI (15 or
168 30 min), regardless of the colour codes (Table 6). In this series, the three cases of
169 early neonatal death involved very preterm birth before 25 weeks of gestation in
170 unfavourable clinical contexts.

171 We did not observe any significant changes in neonatal status following either
172 code red or orange caesareans between 2007 and 2017 (Table 7).

Discussion

173

174

175 The passive dissemination of a protocol was associated with a reduction in the
176 DDI in all maternity units regardless of their level of care and degree of emergency
177 for caesarean births, without however any significant modification in neonatal status.
178 The proportion of intervals adhering to the protocol rose significantly but did not reach
179 their maximum among the level 1 and 2 maternity units.

180

181 The characteristics of the two groups are not totally comparable. The
182 differences observed in terms of maternal age and proportion of previous caesarean
183 section correspond to national and international epidemiological evolutions (15).
184 Moreover, the number of maternity units decreased, especially in grouping smaller
185 ones. This could have had an impact on the DDI because the remaining structures
186 being larger, they work more frequently onsite than offsite when they are on-call. In
187 our study, as in that by Huissoud et al. (9), the presence at the hospital of the entire
188 medical team is decisive for the DDI. That is, when the medical team was not
189 complete at the time the decision was made, fewer than 20% of the caesareans were
190 performed in the recommended delays. These data are consistent with the analysis
191 of the causes of longer intervals in the Australian audit (16), which found difficulties in
192 setting up a complete team in level 1 maternity units. The DDI for code red
193 caesareans was longer and less often shorter than 15 minutes in the level 1,
194 compared with level 2 and 3 maternity units. Two studies conducted in different levels
195 of maternity units in France and in Australia (9,16) also found significantly longer
196 DDIs in level 1 than in level 2 units, which in turn had significantly longer DDIs than
197 those measured in level 3 units.

198 Nonetheless, the reduction in the intervals observed in all the facilities,
199 regardless of the hospital's organisation, is probably due to the dissemination and
200 application of the colour code protocol which enabled effective communication of the
201 extent of the emergency to the entire team. Individualised feedback of their data to
202 maternity units, which took place after the 2007 study, may have enabled teams to
203 become aware of their delays, which are difficult to document in emergency
204 situations (16); this feedback might thus have contributed to their reduction. New
205 feedback was therefore provided after this study as well. The improvement of

206 practices by setting up strategies to minimise delays while maximising maternal and
207 fetal security is multifactorial. Beyond the elaboration of protocols, the performance of
208 repeated audits assessing professional practices (17,18) and the development of
209 team training and simulation programmes (19) have all shown their worth.

210 Although the use of colour codes enables the achievement of very short DDIs,
211 emergency caesareans are associated with major complications more often than
212 planned caesareans (20). Nonetheless, like Weiner et al. (21), who showed that the
213 establishment of protocols that diminish DDI was not associated with more maternal
214 complications, we did not observe any difference between the maternal complication
215 rates for code orange and code red caesareans, even though the latter are
216 performed more rapidly. Nonetheless, it is important to adhere carefully to the
217 indications for emergency procedures, because their excessive or abusive use can
218 be harmful, by exposing women to surgical or psychological complications (22) and
219 demotivating the teams (18). The code red caesarean rate for each maternity ward
220 may thus an indicator to be monitored.

221

222 We did not observe significant differences in poor neonatal condition
223 regardless of the actual intervals. On the other hand, neonatal status was
224 significantly worse for the children born by code red caesareans compared with those
225 born after a code orange. Similarly, all the deaths in this study followed code red
226 caesareans. These data are consistent with the literature, which reports no
227 improvement in neonatal outcome when caesareans are performed within 30 minutes
228 of the decision (6,17,23–26). On the other hand, in a cohort of 17,780 English
229 newborns delivered by caesarean sections, Thomas et al. (27) showed that neonatal
230 outcomes were impaired when the DDI exceeded 75 minutes. Several studies also
231 found impairment of fetal indicators for the most extreme emergency caesareans
232 (28,29). These observations do not mean that reduction of DDI has no useful effect
233 on neonatal outcome but may be explained by the fact that code red caesareans
234 essentially correspond to the most serious situations with children at the greatest risk
235 of anoxia. Moreover, the release of stress-induced maternal catecholamines leads to
236 a reduction in placental perfusion and therefore to a lower fetal pH in the most rapid
237 births (23).

238 During analyses of neonatal sequelae following prolonged fetal anoxia, in legal
239 cases in particular, the delay in operative intervention may well be reproached and

240 will certainly be analysed by judges, juries, and medical experts. We have seen that
241 in extreme emergency situations, operative intervention in less than 15 minutes does
242 not guarantee good neonatal status or long-term absence of sequelae. Moreover,
243 despite their efforts, achieving delivery within the recommended intervals remains
244 difficult for numerous facilities. The studies finally suggest that 90% of the cases of
245 cerebral palsy are associated with prenatal events (3). Accordingly, as Thomas et al.
246 (27) suggest, the definition of an "ideal DDI" appears important in motivating teams to
247 perform a very short operative intervention in emergency situations. Nonetheless, no
248 scientific data make it possible to define a threshold interval that will guarantee
249 favourable maternal and neonatal outcomes.

250

251 Strengths and limitations

252 This multicentre study in the general population compared, within a perinatal
253 network, changes in practices after 11 years and the implementation of a protocol
254 and various actions aimed at improving practices. Its principal interest is that it shows
255 improvement of DDIs through the application of a common protocol, not on the scale
256 of a single maternity ward, but for the entire population of a network composed of
257 maternity units of different sizes and with difference forms of organisation.

258

259 A methodological weakness of this study is the undoubted Hawthorne effect,
260 that is, modifications of behaviour induced in people who know they are being
261 observed (30). It might have reduced the DDIs by improving the reactions of people
262 who know that their behaviour in these emergency situations is being evaluated.

263 The failure to observe any improvement in neonatal outcome may be
264 explained by the study's lack of power. That is, the variations in neonatal morbidity
265 and mortality are difficult to show because severe neonatal mortality and hypoxia are
266 quite rare events. Because this was a secondary study objective, the calculation of
267 the sample size required was not performed to answer this question. It is also
268 possible that the DDI variations observed were insufficient to obtain an improvement
269 in neonatal outcome. Finally, the neonatal prognosis probably depends more on the
270 cause of the fetal distress than on the DDI. It would be interesting to perform a study
271 on this specific point.

272 **Conclusion**

273

274 The establishment of the colour code protocol was associated with a
275 significant reduction in DDIs and an improvement in the intervals required for all of
276 the maternity units of our large perinatal network but did not affect the neonatal
277 outcome. The persistence of large disparities in teams' ability to perform all
278 caesarean deliveries in the medically required intervals require us to continue
279 these efforts and to monitor these rates regularly.

280

281

282 **Acknowledgements**

283

284 The authors thank: Sylvianne CHALANCON and Catherine MORESTIN for the
285 data collection as well as all the maternity unit teams of the AURORE network for
286 their participation.

287

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373

Table 1: Maternal and neonatal characteristics by each period

	2007 (n=447)	2017 (n=478)	p
Mothers' characteristics			
<i>Age, med./IQR</i>	29 [26-33]	30 [27-35]	0,001
Parity	1 [1-2]	1 [1-2]	0,3
<i>Previous caesarean n (%)</i>	45 (10,1)	86 (18.0)	0,001
<i>Twin pregnancy, n (%)</i>	17 (3,8)	11 (2.3)	0,18
<i>Postpartum haemorrhage, n (%)</i>	28 (6,3)	65 (13.6)	0,0003
<i>Surgical revision, n (%)</i>	1 (0,2)	0	0,48
<i>Infection, n (%)</i>	2 (0,4)	0	0,23
<i>Bladder wound, n (%)</i>	0	5 (1.0)	0,06
Neonatal characteristics			
<i>Gestational age (weeks), med./IQR</i>	40+0 [38+2 – 41+0]	39+6 [38+4 - 40+6]	0,9
<i>Weight (g), med./IQR</i>	3240 [2780- 3610]	3190 [2782- 3530]	0,3
<i>Preterm birth <37 weeks (%)</i>	62 (13,9)	64 (13.4)	0,9
<i>Preterm birth <32 weeks (%)</i>	13 (2,9)	12 (2.5)	0,7
<i>Preterm birth <28 weeks</i>	3 (0,7)	6 (1.3)	0,5
<i>Post-term</i>	90 (20,1)	113 (23.6)	0,2
<i>5-min Apgar ≤ 3</i>	3 (0,7)	6 (1.3)	0,5
<i>pH < 7</i>	6/166 (3,6)	17/416 (4.1)	0,8
<i>External cardiac massage</i>	5 (1,1)	10 (2.1)	0,2
<i>Intubation</i>	12 (2,7)	23 (4.8)	0,09
<i>Hood/ventilation</i>	7 (1,6)	32 (6.7)	p < 0,0001
<i>Early death</i>	4 (0,9)	3 (0.6)	0,7

Table 2: Maternal and neonatal characteristics by the maternity unit level

	Total (n=478)	Level 1 (n = 254)	Level 2 (n = 183)	Level 3 (n = 41)	p
Mothers' characteristics					
<i>Age, med./IQR</i>	30 [27-35]	30 [26-35]	31 [27-36]	31 [29-36]	0.18
<i>Parity</i>	1 [1-2]	1 [1-2]	1 [1-2]	1 [1-1]	0.02
<i>Previous caesarean n (%)</i>	86 (18.0)	56 (22.0)	26 (14.2)	4 (9.7)	0.82
<i>Twin pregnancy, n (%)</i>	11 (2.3)	4 (1.6)	7 (3.8)	0	0.24
<i>Postpartum haemorrhage, n (%)</i>	65 (13.6)	28 (11.0)	28 (15.3)	9 (21.9)	0.08
<i>Surgical revision, n (%)</i>	0	0	0	0	NA
<i>Infection, n (%)</i>	0	0	0	0	NA
<i>Bladder wound, n (%)</i>	5 (1.0)	4 (1.6)	1 (0.5)	0	0.62
Neonatal characteristics					
<i>Gestational age (weeks), med./IQR</i>	39+6 [38+4 - 40+6]	40 [38+2 - 40+6]	39+6 [38+4 - 41]	40+2 [38+6 - 41+1]	0.61
<i>Weight (g), med./IQR</i>	3190 [2782- 3530]	3160 [2790 - 3488]	3200 [2819 - 3530]	3285 [2630 - 3615]	0.89
<i>Preterm birth <37 weeks (%)</i>	64 (13.4)	31 (12.2)	28 (15.3)	5 (12.2)	0.63
<i>Preterm birth <32 weeks (%)</i>	12 (2.5)	2 (0.8)	5 (2.7)	5 (12.2)	0.001
<i>Preterm birth <28 weeks</i>	6 (1.3)	1 (0.4)	1 (0.5)	4 (9.7)	0.005
<i>Post-term</i>	113 (23.6)	51 (20.1)	49 (26.8)	13 (31.7)	0.12
<i>5-min Apgar ≤ 3</i>	6 (1.3)	2 (0.8)	1 (0.5)	3 (7.3)	0.02
<i>pH < 7</i>	17/416 (4.1)	9/209 (4.3)	5/168 (3.0)	3/39 (7.7)	0.72
<i>External cardiac massage</i>	10 (2.1)	5 (2.0)	3 (1.6)	2 (4.9)	0.36
<i>Intubation</i>	23 (4.8)	10 (3.9)	7 (3.8)	6 (14.6)	0.11
<i>Hood/ventilation</i>	32 (6.7)	13 (5.1)	16 (8.7)	3 (7.3)	0.30
<i>Meconium aspiration</i>	7 (1.5)	3 (1.2)	3 (1.6)	1 (2.4)	0.49
<i>Early death</i>	3 (0.6)	1 (0.4)	0	2 (4.9)	0.02

Table 3: Principal indications for caesarean deliveries

<i>Indications, n (%)</i>	Code orange N = 355				Code red N = 123			
	Level 1 (n = 190)	Level 2 (n = 137)	Level 3 (n = 28)	Total (n =355)	Level 1 (n = 64)	Level 2 (n = 46)	Level 3 (n = 13)	Total (n =123)
<i>Fetal heart rate anomaly</i>	139 (73.2)	95 (69.3)	23 (82.1)	257 (72.4)	56 (87.5)	34 (73.9)	12 (92.3)	102 (82.9)
<i>Preeclampsia/Eclampsia</i>	10 (5.3)	3 (2.2)	0	13 (3.7)	1 (1.6)	2 (4.3)	0	3 (2.4)
<i>Maternal shock</i>	0	0	0	0	0	2 (4.3)	1 (7.7)	3 (2.4)
<i>Vaginal bleeding/Suspected placental abruption</i>	9 (4.7)	6 (4.4)	0	15 (4.2)	6 (9.4)	7 (15.2)	1 (7.7)	14 (11.4)
<i>Suspected uterine rupture</i>	11 (5.8)	2 (1.5)	0	13 (3.7)	1 (1.6)	2 (4.3)	1 (7.7)	4 (3.3)
<i>Cord prolapse</i>	0	1 (0.7)	0	1 (0.3)	3 (4.7)	5 (10.9)	1 (7.7)	9 (7.3)
<i>Dystocic presentation</i>	13 (6.8)	11 (8.0)	0	24 (6.8)	3 (4.7)	3 (6.5)	0	6 (4.9)
<i>Failed operative intervention</i>	6 (3.2)	10 (7.3)	3 (10.7)	19 (5.4)	5 (7.8)	5 (10.9)	0	10 (8.1)
<i>Contraindication to vaginal delivery</i>	4 (2.1)	7 (5.1)	1 (3.6)	12 (3.4)	0	0	0	0
<i>Failure to progress</i>	52 (27.4)	35 (25.5)	9 (32.1)	96 (27)	5 (7.8)	1 (2.2)	1 (7.7)	7 (5.7)

Table 4: Decision-delivery interval of emergency caesareans

Level	Code orange				Code red			
	2007		2017		2007		2017	
	n	DDI (min) med.[IQR]	DDI (min) med.[IQR]	n	n	DDI (min) med.[IQR]	DDI (min) med.[IQR]	n
1	181	48 [37-64]	36 [28-48.75]	190	29	35 [25-45]	19.5 [14-25]	64
2	169	40 [29-54]	25 [20-32]	137	42	24 [18-33]	12 [9-15]	46
3	15	22 [15-33]	18.5 [16-24]	28	11	13 [11-15]	10 [8-11]	13

For 2017:

- p-value DDI type 1 versus 2: Code orange $p < 0.0001$ // Code red $p < 0.0001$
- p-value DDI type 1 versus 3: Code orange $p < 0.0001$ // Code red $p < 0.0001$
- p-value DDI type 2 versus 3: Code orange $p < 0.0001$ // Code red $p = 0.08$

Table 5: Proportion of caesareans performed in the time limits corresponding to the degree of the emergency

Level	Code orange $\leq 30'$			Code red $\leq 15'$		
	2007	2017	p	2007	2017	p
1	16% (29/181)	33% (62/190)	0.0003	10% (3/29)	36% (23/64)	0.01
2	25% (42/169)	67% (92/137)	< 0.0001	17% (7/42)	83% (38/46)	< 0.0001
3	67% (10/15)	96% (27/28)	0.015	73% (8/11)	100% (13/13)	0.039
Total	22% (81/365)	51% (181/355)	< 0.0001	22% (18/82)	60% (74/123)	< 0.0001

For 2017:

- p-value type 1 versus 2: Code orange $\leq 30'$ $p < 0.0001$ // Code red $\leq 15'$ $p < 0.0001$
- p-value type 1 versus 3: Code orange $\leq 30'$ $p < 0.0001$ // Code red $\leq 15'$ $p < 0.0001$
- p-value type 2 versus 3: Code orange $\leq 30'$ $p = 0.004$ // Code red $\leq 15'$ $p = 0.25$

Organisation	Code orange $\leq 30'$			Code red $\leq 15'$		
	A + O offsite (B)	A onsite + O offsite (C)	A + O onsite (D)	A + O offsite (B)	A onsite + O offsite (C)	A + O onsite (D)
2007	Unavailable data			Unavailable data		
2017	18% (2/11)	13% (2/15)	55% (163/296)	0	17% (1/6)	64% (68/107)

* A = Anesthetist / O = Obstetrician

For 2017:

- p-value (B+C) versus (D) Code orange $\leq 30'$ $p < 0.0001$
- p-value (C) versus (D) Code red $\leq 15'$ $p < 0.0001$

Table 6: Neonatal outcome according to DDI

Neonatal outcome, n (%)	<i>Code orange (354) **</i>			<i>Code red (123)</i>		
	DDI ≤ 30' (178)	DDI > 30' (176)	p	DDI ≤ 15' (74)	DDI > 15' (49)	p
<i>5-min Apgar 3</i>	1 (0.6)	0	1*	3 (4.0)	2 (4.2)	1*
<i>pH < 7</i>	3/153 (2)	3/142 (2.1)	1*	9/70 (14.3)	2/35 (6.3)	0.33*
<i>External cardiac massage</i>	1 (0.6)	3 (1.7)	0.37*	4 (5.3)	2 (4.2)	1*
<i>Intubation</i>	4 (2.2)	4 (2.3)	1*	8 (10.7)	5 (10.4)	1
<i>Hood/ventilation</i>	9 (5.1)	7 (4.0)	0.8	9 (12.0)	7 (14.6)	0.79
<i>Meconium aspiration</i>	2 (1.1)	3 (1.7)	0.68*	1 (1.3)	1 (2.1)	1*
<i>Early death</i>	0	0	NA	2 (2.7)	1 (2.1)	1*

* Fisher exact test ** DDI not available for one Caesarean code orange

Table 7: Comparison of neonatal outcomes between 2007 and 2017

Neonatal outcome, n (%)	<i>Code orange</i>			<i>Code red</i>		
	2007 (n=365)	2017 (n=355)	p	2007 (n=82)	2017 (n=123)	p
<i>5-min Apgar 3</i>	1 (0.3)	1 (0.3)	0.98	2 (2.4)	5 (4.1)	0.53
<i>pH < 7</i>	1/113 (0.9)	6/294	0.42	4/41 (9.8)	11/105 (10.5)	0.90
<i>External cardiac massage</i>	1 (0.3)	4 (1.1)	0.17	5 (6.1)	6 (4.9)	0.70
<i>Intubation</i>	7 (1.9)	8 (2.3)	0.75	6 (7.3)	13 (10.6)	0.46
<i>Hood/ventilation</i>	8 (2.2)	16 (4.5)	0.08	12 (14.6)	16 (12.7)	0.74
<i>Early death</i>	1 (0.3)	0	0.32	4 (4.9)	3 (2.4)	0.35