

**Induction of labor:
Not as bad as you think!
ARRIVE**

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When is the best time for delivery?



≥ 42 wks

< 39 wks

Delivery

**Expectant
management**

39 - 41 wks ?

**Increasing maternal and
perinatal risks after 39 weeks**

Maternal Complications

- **Pregnancies that continue beyond 39 weeks are associated with increased risks of:**
 - **Cesarean delivery**
 - **Operative vaginal delivery**
 - **3rd and 4th degree lacerations**
 - **Febrile morbidity**
 - **Hemorrhage**

Perinatal Complications

- **Pregnancies that continue beyond 39 weeks are associated with increased risks of:**
 - **Stillbirth**
 - **Meconium aspiration syndrome**
 - **Mechanical ventilation**
 - **Birth trauma**
 - **Neonatal seizures/ICH/ encephalopathy**
 - **Neonatal sepsis**
 - **UA pH ≤ 7 /BE < -12**

Perinatal Death

- Perinatal death nadirs between 37-38 weeks and increases steadily thereafter

Gestational Age	Loss Rate
37	0.7/1000
38	1.3/1000
39	1.4/1000
40	2.4/1000
41	2.8/1000

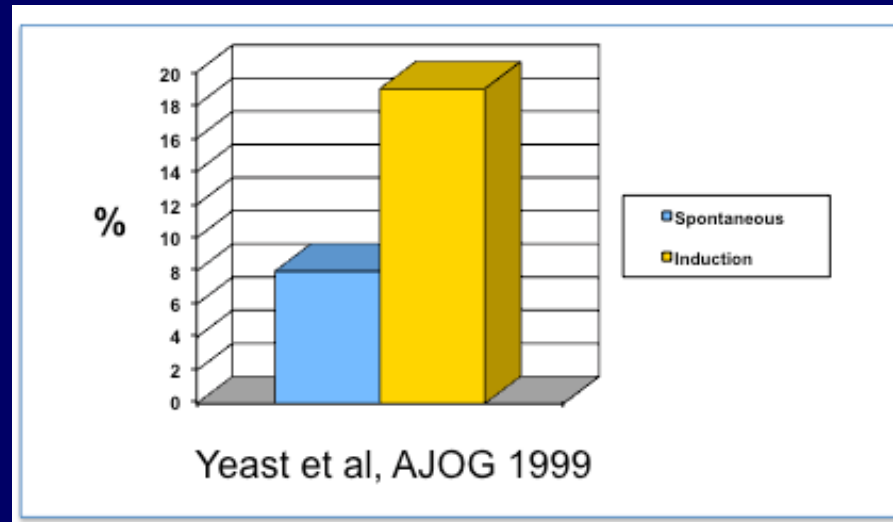
When is the best time for delivery?



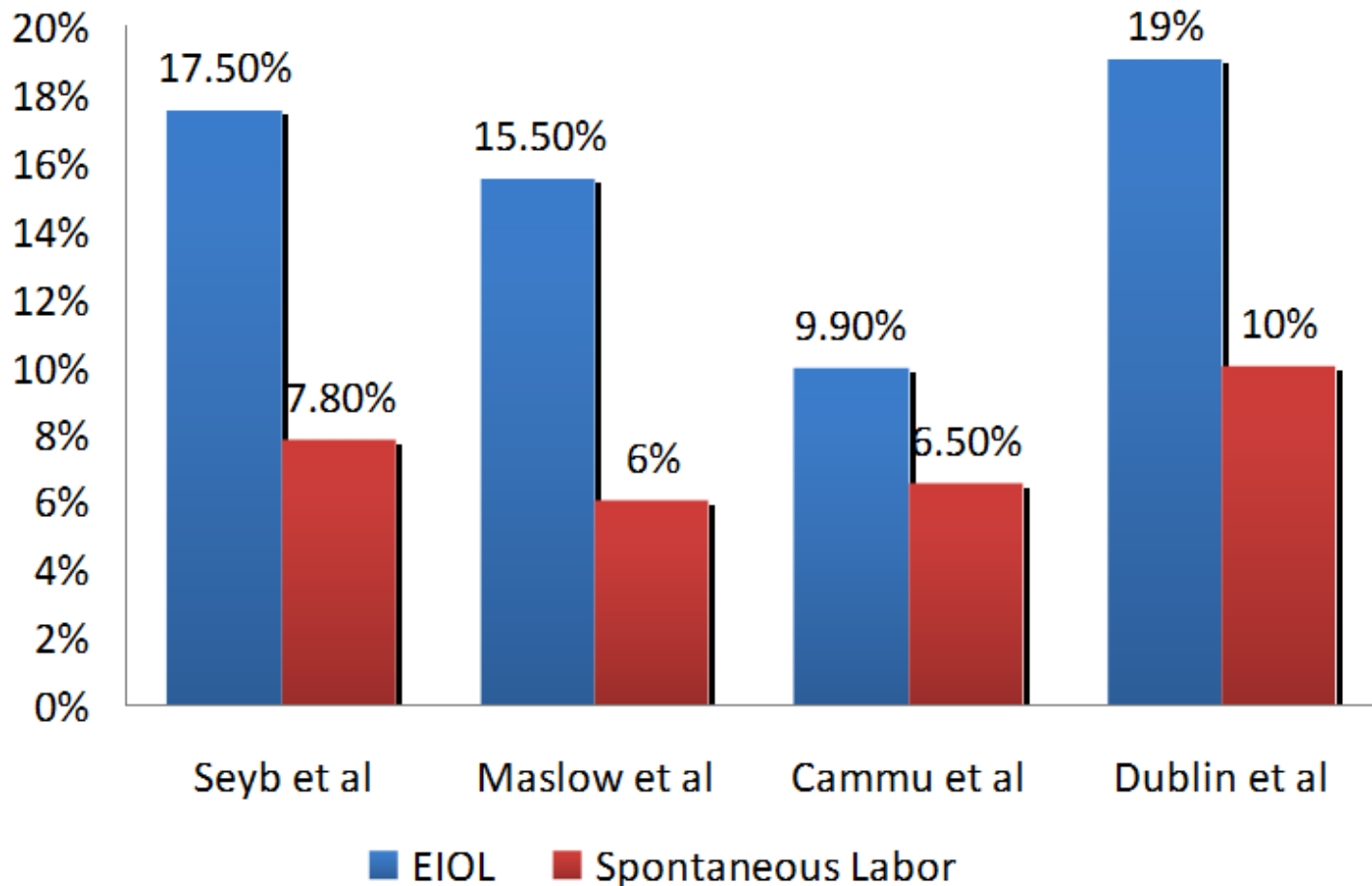
39 - 41 weeks

Induction and cesarean delivery: Common wisdom

- Retrospective cohort studies
 - Induction of labor prior to 41 weeks of gestation is associated with an approximately 2-fold higher risk of cesarean delivery in nulliparous women



Elective inductions only



When is the best time for delivery?



39 - 41 weeks

Standard of Care

- **Patients undergoing induction of labor should be counseled about a 2 – fold increased risk of cesarean**

The problem

- **Spontaneously laboring women are not the right comparison group**
 - Cannot choose between EIOl (strategy) and spontaneous labor (event)
 - Choice is between EIOl and expectant management
 - The latter may lead to spontaneous labor
 - Also conveys downstream possibilities that may increase the CS rate



39 weeks

N= 100

Spontaneous labor



CS rate=20%
N=20

IOL



CS rate=35%
N=35



**39 weeks
N= 100**

**N=100
30% Spontaneous
labor**



**50% labor at 40
weeks**



Medical or Post dates IOL



**CS rate=20%
N=6**

**CS rate=30%
N=11**

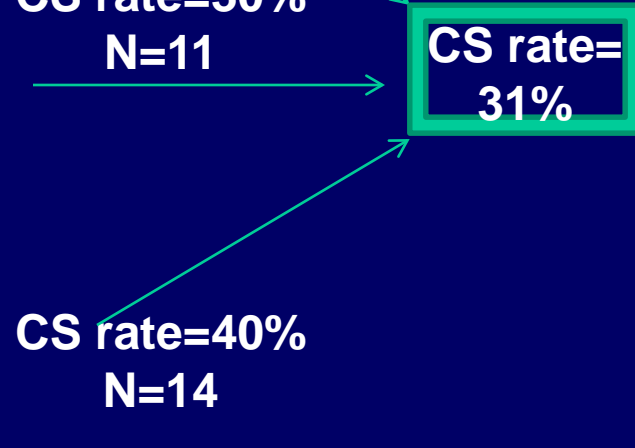
**CS rate=40%
N=14**

**CS rate=
31%**

IOL



**CS rate=35%
N=35**



Induction vs. Expectant Management (CS%)

Week of Induction	IOL	Spontaneous
38 weeks	11.9%	7.0%
39 weeks	14.3%	9.1%
40 weeks	20.4%	10.9%
41 weeks	24.3%	14.9%

Caughey et al, AJOG 2006;195:700-5

Induction vs. Expectant Management (CS%)

Week of Induction	IOL	Spontaneous	Expectant	aOR (95% CI)
38 weeks	11.9%	7.0%	13.3%	1.80 (1.29-2.53)
39 weeks	14.3%	9.1%	15.0%	1.39 (1.08-1.80)
40 weeks	20.4%	10.9%	19.0%	1.24 (1.27-1.62)
41 weeks	24.3%	14.9%	26.0%	1.26 (0.99-1.61)

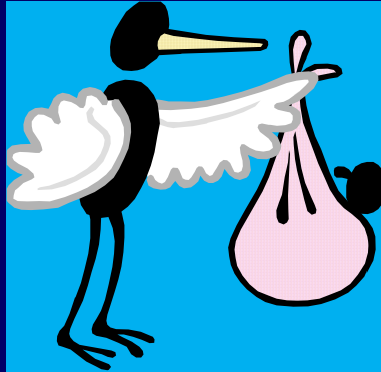
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Conclusions

- We know that at 41-42 weeks, IOL better than EM
- We know that before 39 weeks, EM better than IOL
- Between 39 and 41 weeks:
 - Common wisdom that EM is better than IOL
 - Maternal and neonatal outcomes worsen with delivery after 39 weeks
 - The concern that IOL increases CD is founded on methodologically flawed study design
 - Common practice is moving away from EM
 - We actually don't know whether EM or IOL is better

Conclusions

An adequately powered study of elective induction of nulliparous women is needed



Induction in Nulliparous Women at 39 Weeks to Prevent Adverse Outcomes: A Randomized Controlled Trial

A Randomized Trial of Induction Versus Expectant Management (ARRIVE)

Objective

To test the hypothesis that elective induction of labor at 39 weeks compared with expectant management among low-risk nulliparous women reduces the risk of a composite of perinatal mortality and severe neonatal morbidity

Methods

- **Randomized, controlled, parallel group, unmasked trial**
- **Inclusion criteria**
 - **Nulliparous women**
 - **Singleton gestations**
 - **Reliably dated**
 - **No contraindication to vaginal delivery**
 - **Low risk**

Methods

- **Randomized between 38 0/7 and 38 6/7 weeks of gestation**
 - **IOL vs. EM**
 - **Cervical examination at randomization**
 - **Post-delivery interviews**
 - **Labor pain**
 - **Labor Agency Scale**

Methods: Primary outcome

- **Composite describing perinatal mortality or severe morbidity**
 - Fetal or neonatal death
 - Respiratory support within the first 72 hours of life
 - Apgar score ≤ 3 at 5 minutes
 - Hypoxic ischemic encephalopathy
 - Seizure
 - Infection
 - Meconium aspiration syndrome
 - Birth trauma
 - Intracranial or subgaleal hemorrhage
 - Hypotension requiring pressor support

Methods: Maternal outcomes

- **Cesarean delivery**
- **Hypertensive disorder of pregnancy**
- **Postpartum hemorrhage**
- **Chorioamnionitis**
- **Endometritis**
- **Post-partum length of stay**
- **Labor pain**
- **Labor Agency Scale**

Methods: Subgroup analysis

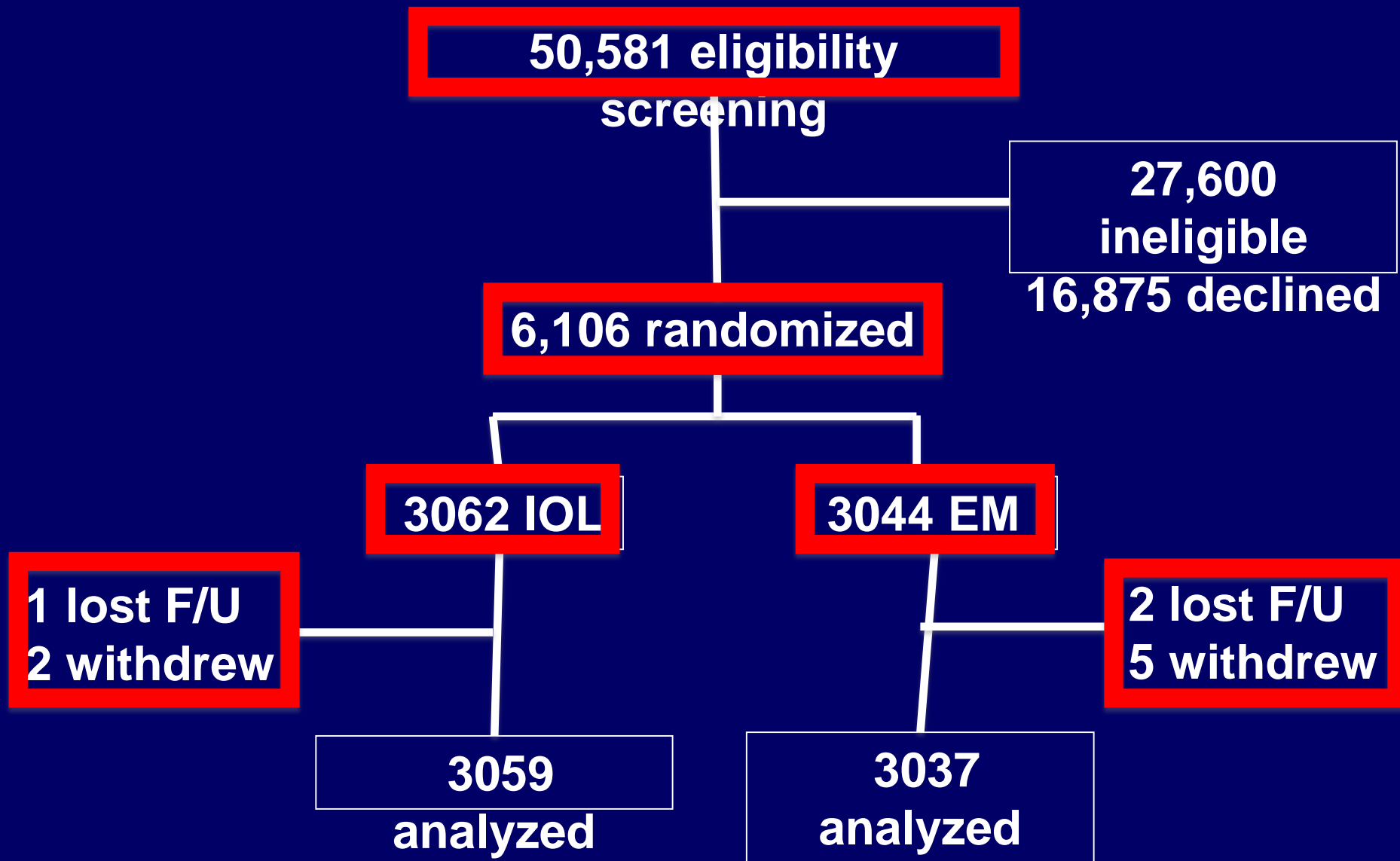
- **Race/ethnicity**
- **Maternal age**
- **BMI**
- **Modified Bishop score**

Methods: Sample Size

- **Expected rate of the primary outcome: 3.5%**
- **Compliance with group assignment: 92.5%**
- **Power: 85%**
- **Alpha: 5%**
- **RR decrease: 38%**
- **N = 6000**

Results

Results: CONSORT diagram



Results: Patient characteristics

	IOL	EM
Maternal age – yr.	24 (21-28)	23 (20-28)
Race and ethnicity		
Non-Hispanic white	1329 (43.4)	1359 (44.7)
Non-Hispanic black	707 (23.1)	699 (23.0)
Asian	87 (2.8)	106 (3.5)
Hispanic	866 (28.3)	808 (26.5)
Other or unknown	73 (2.4)	72 (2.4)
Private insurance for prenatal care	1404 (45.9)	1335 (43.9)
Previous pregnancy loss	698 (22.8)	778 (25.6)
BMI \geq 30 kg/m ² at randomization	1633 (53.6)	1575 (52.0)
Modified Bishop score at randomization $<$ 5	1919 (62.7)	1954 (64.2)

Data are presented as median (interquartile range) or N (%)

Results

- **IOI vs. EM:**
 - **39.3 weeks vs. 40.0 weeks, $P < .001$**
 - **3300g vs. 3380g, $P < .001$**

Results: Perinatal

	IOL N (%)	EM N (%)	RR	95% CI
Perinatal composite	133 (4.3)	164 (5.4)	0.80	0.64 - 1.00
Respiratory support	91 (3.0)	127 (4.2)	0.71	0.55 - 0.93
Perinatal death	2 (0.1)	2 (0.1)	0.66	0.12 - 3.33
Apgar ≤ 3 at 5 minutes	12 (0.4)	18 (0.6)	0.66	0.32 - 1.37
HIE	13 (0.4)	19 (0.6)	0.68	0.34 - 1.37
Seizure	11 (0.4)	4 (0.1)	2.73	0.91 - 8.12
Infection	10 (0.3)	12 (0.4)	0.83	0.36 - 1.91
MAS	17 (0.6)	26 (0.9)	0.65	0.35 - 1.19
Birth trauma	14 (0.5)	18 (0.6)	0.77	0.38 - 1.55
ICH or subgaleal hemorrhage	9 (0.3)	7 (0.2)	1.28	0.48 - 3.42
Hypotension	3 (0.1)	5 (0.2)	0.60	0.13 - 2.27

Results: Maternal

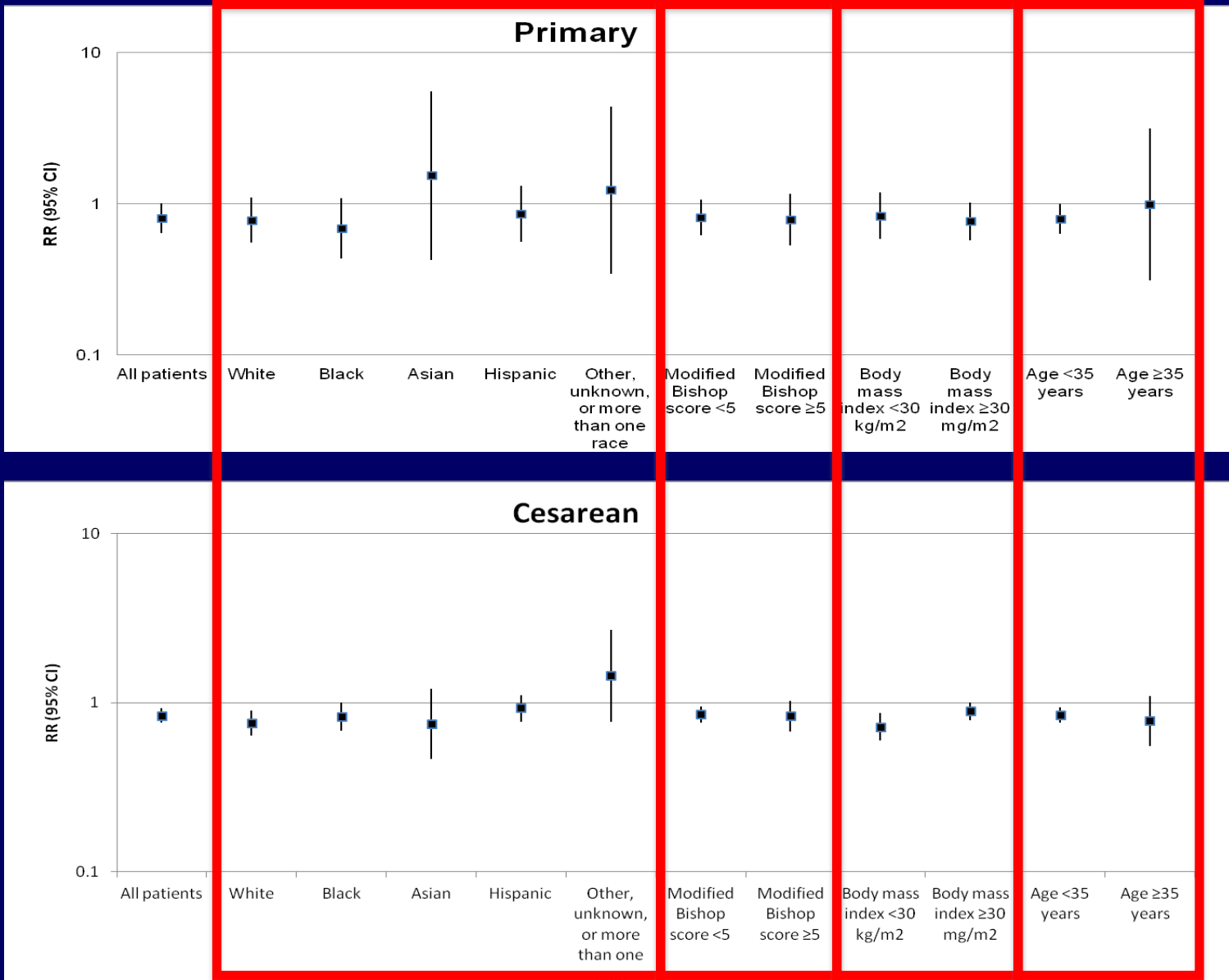
	IOL N (%)	EM N (%)	RR	95% CI
Cesarean delivery	569 (18.6)	674 (22.2)	0.84	0.76 - 0.93
Hypertensive disorder of pregnancy	277 (9.1)	427 (14.1)	0.64	0.56 - 0.74
Chorioamnionitis	407 (13.3)	429 (14.1)	0.94	0.83 - 1.07
Third or fourth degree perineal laceration	103 (3.4)	89 (2.9)	1.15	0.87 - 1.52
Postpartum hemorrhage	142 (4.6)	137 (4.5)	1.03	0.82 - 1.29
Postpartum infection	50 (1.6)	65 (2.1)	0.76	0.53 - 1.10
Admission to intensive care unit	4 (0.1)	8 (0.3)	0.50	0.13 - 1.55

Results: Maternal

	IOL	EM	P
PP length of stay - day	2 (2-2)	2 (2-2)	.01
Labor Agency Score after delivery	168 (148-183)	164 (143-181)	<.001
Labor Agency Score 6 wk after delivery	176 (157-189)	174 (154-188)	.01
Worst labor pain	8 (7-10)	9 (8-10)	<.001
Median overall labor pain	7 (5-8)	7 (5-9)	<.001

All data are presented as medians (interquartile range)

Subgroup analyses



Conclusion

- **Labor induction:**
 - No change in perinatal composite outcome
 - Lower frequency of
 - Neonatal respiratory support
 - Cesarean delivery
 - Hypertensive disorder of pregnancy
 - Shorter postpartum hospital stay
 - Lower perceived pain in labor
 - Greater perceived control during childbirth

Conclusion

- **Strengths**
 - **Size**
 - **Strict criteria for dating**
 - **Generalizability**

Conclusion

- **Limitations**
 - **Not masked**
 - **Low power to detect differences in infrequent outcomes**
 - **Generalizability**

Induce Everyone?

- Of course not!
- Reasonable option for some
- Avoiding induction is unlikely to reduce cesarean rates overall
- Cost analyses
- Many other secondary analyses
- Caution: Hold bias and passion and focus on quality data

**Stay
Tuned!**



**Paradigm
Shift?**

**What do you see?
By shifting perspective you might see an
old woman or a young woman.**

