University Medical Center, Utrecht, the NL

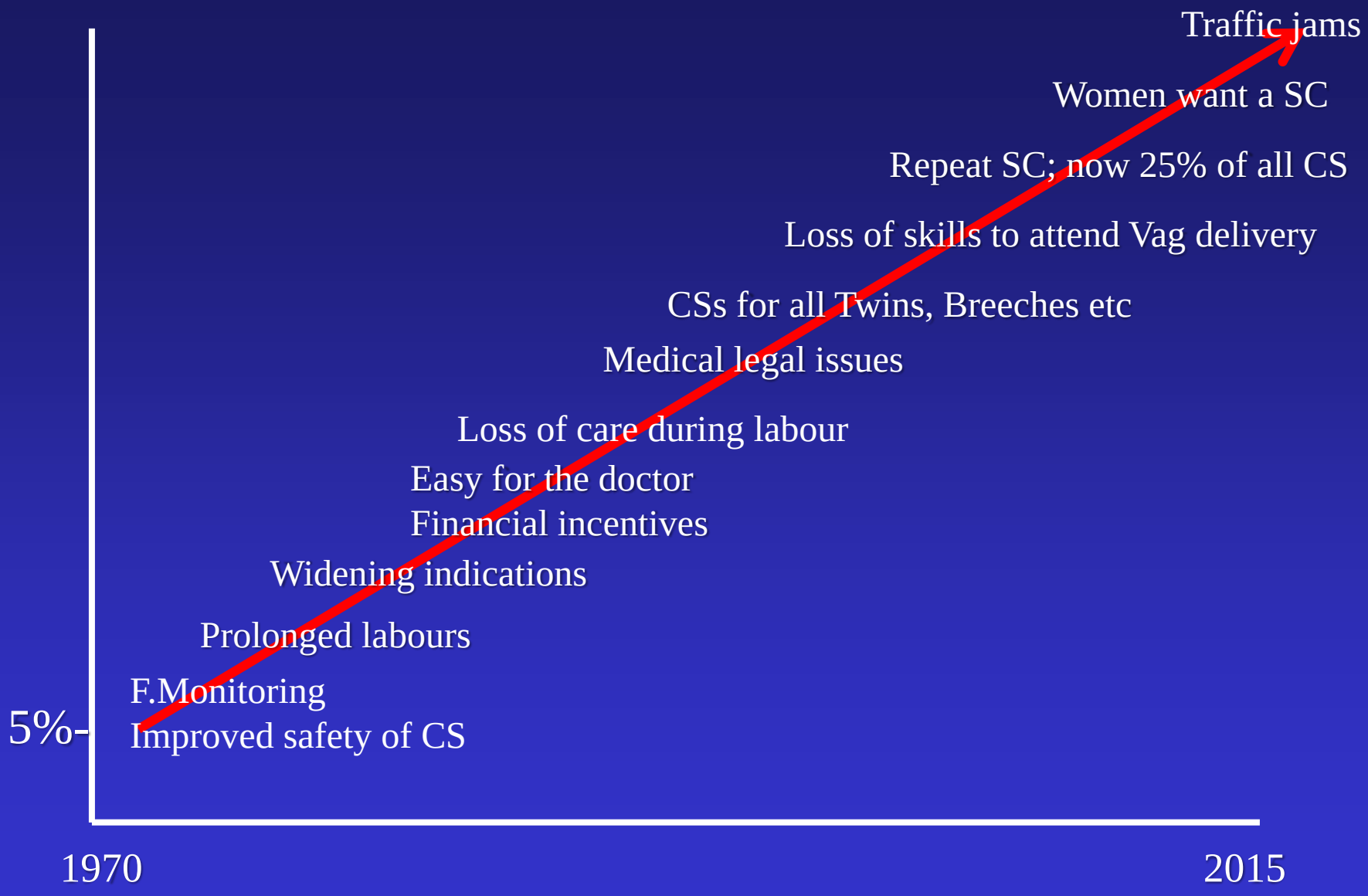
The Cesarean Delivery Epidemic and its consequences

Gerard H.A.Visser

Chair FIGO Committee Safe Motherhood & Newborn Health

FIGO International Federation of Gynecology and Obstetrics

The increase in CSs



Visser, Neonatology, 2015

Women are designed to deliver vaginally

PLOS ONE | Betran et al, 2016

Trend in Caesarean Section Rates 1990-2014

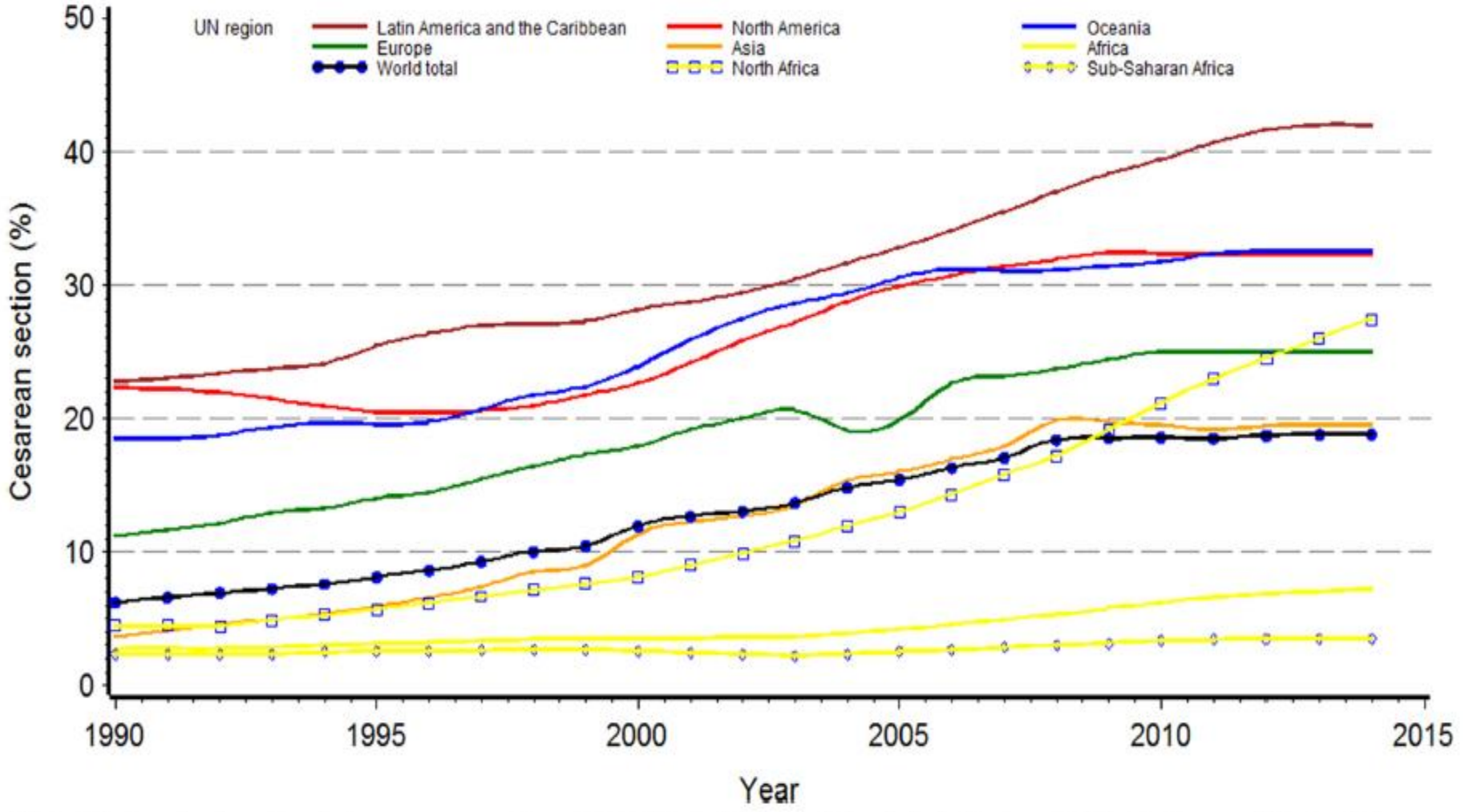
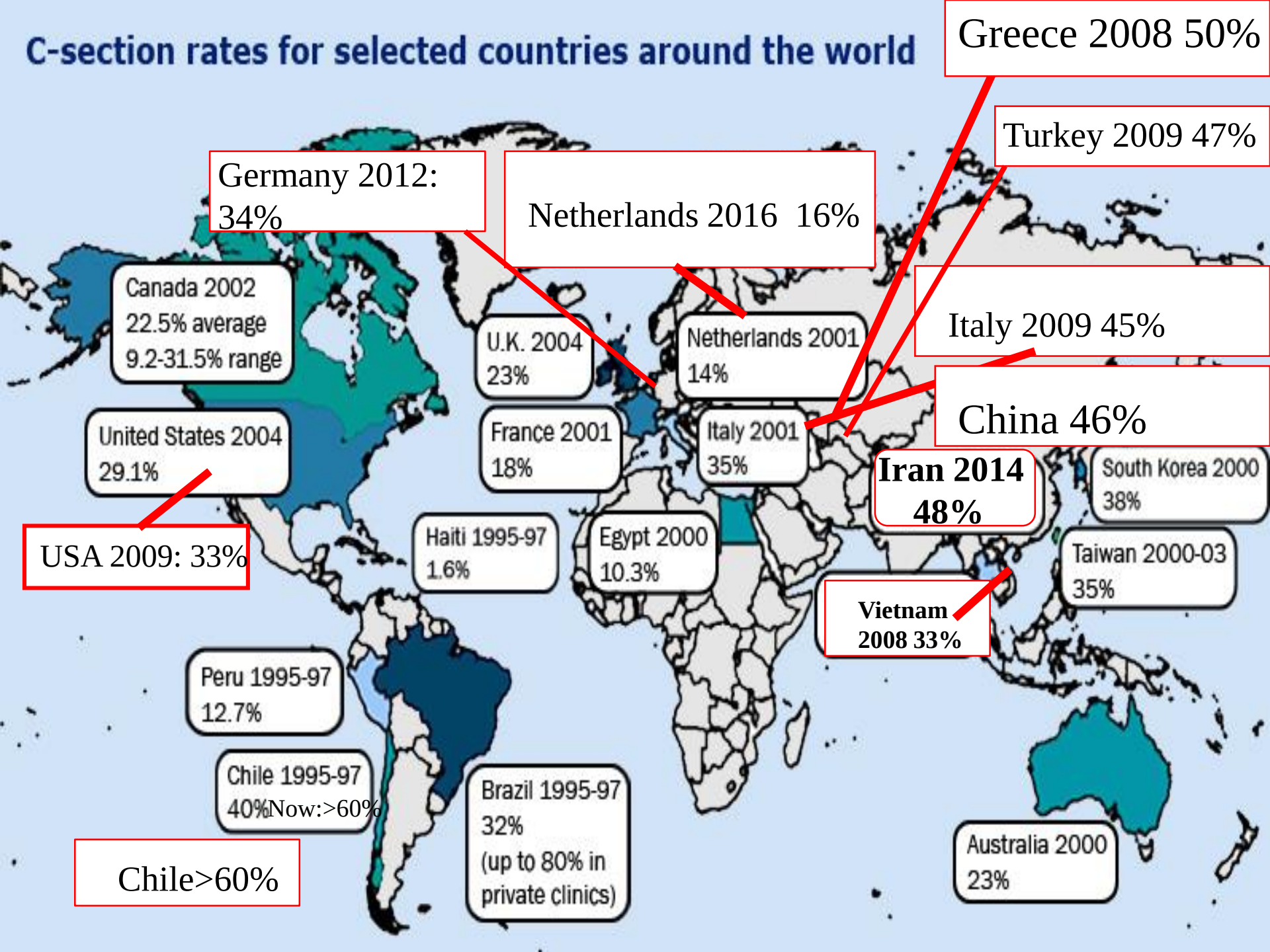
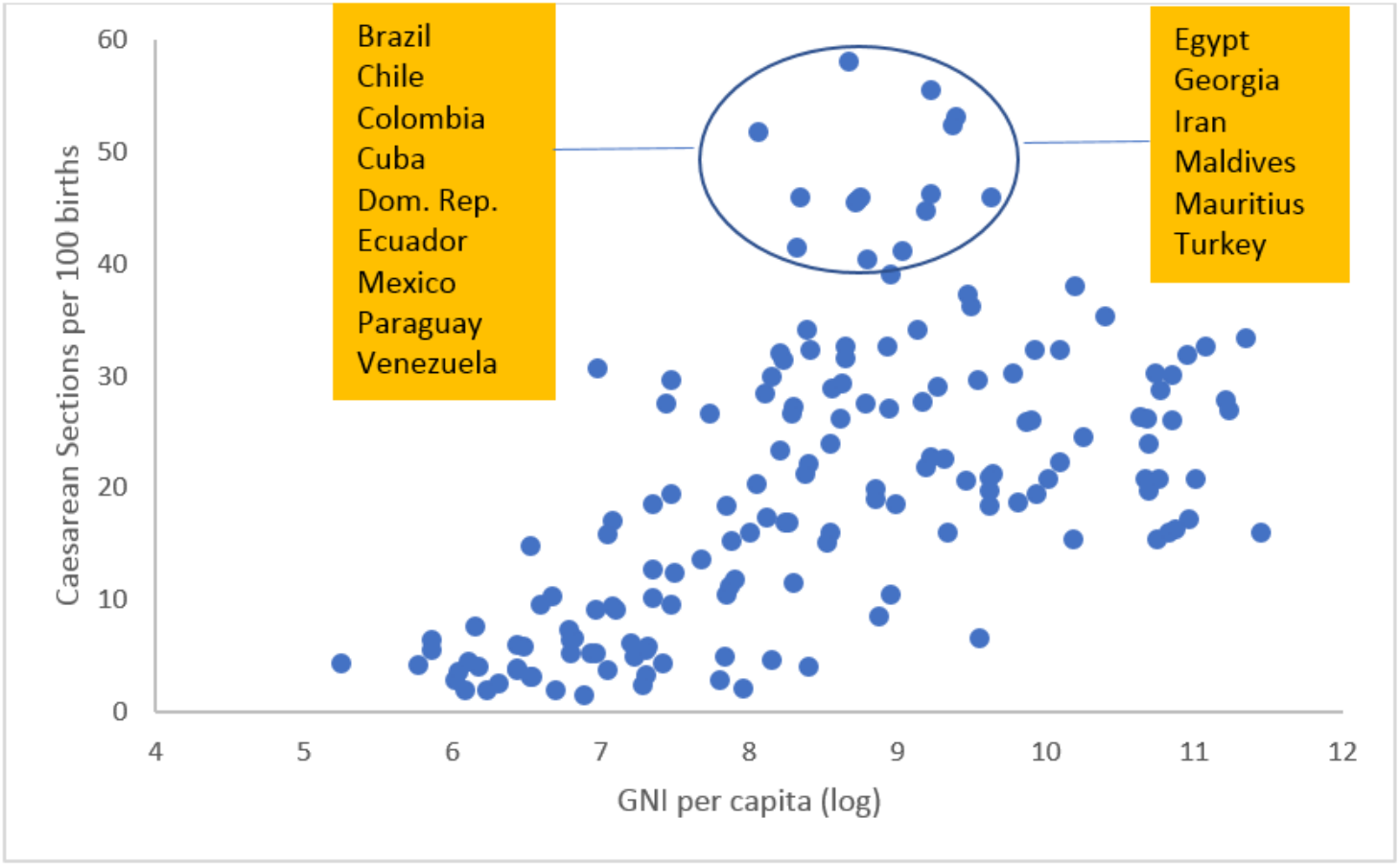


Fig 2. Global and regional trends in caesarean section, 1990–2014. Sub-Saharan Africa includes Eastern, Middle, Southern and Western Africa subregions. For the purpose of this graph, a linear interpolation between available data from 1990 and 2014 was calculated. When data for 2014 were not available, the CS rate for the latest year available was used also for all subsequent years up to 2014.


C-section rates for selected countries around the world
Greece 2008 50%
Turkey 2009 47%
Germany 2012: 34%
Netherlands 2016 16%
Italy 2009 45%
China 46%
Canada 2002
22.5% average
9.2-31.5% range
U.K. 2004
23%
Netherlands 2001
14%
United States 2004
29.1%
France 2001
18%
Italy 2001
35%
Iran 2014
48%
South Korea 2000
38%
USA 2009: 33%
Haiti 1995-97
1.6%
Egypt 2000
10.3%
Taiwan 2000-03
35%
Vietnam
2008 33%
Peru 1995-97
12.7%
Chile 1995-97
40%Now:>60%
Brazil 1995-97
32%
(up to 80% in
private clinics)
Australia 2000
23%
Chile>60%

CS rates by GNI per capita

Figure 3. Caesarean Section rate per 100 births, most recent data 168 countries, by GNI per capita (log) (highlight refers to countries with rates exceeding 40%).



T.Boerma et al, subm

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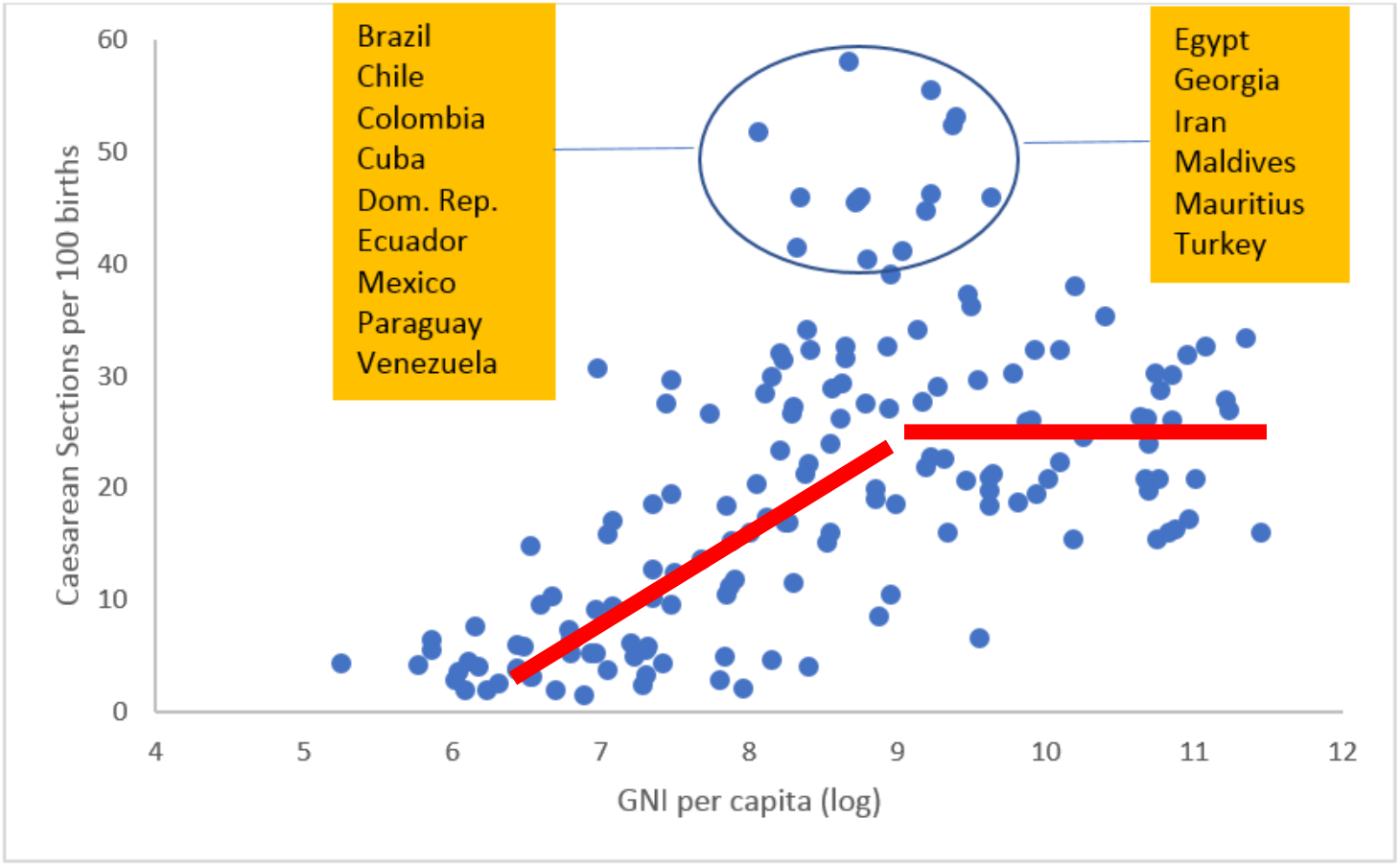
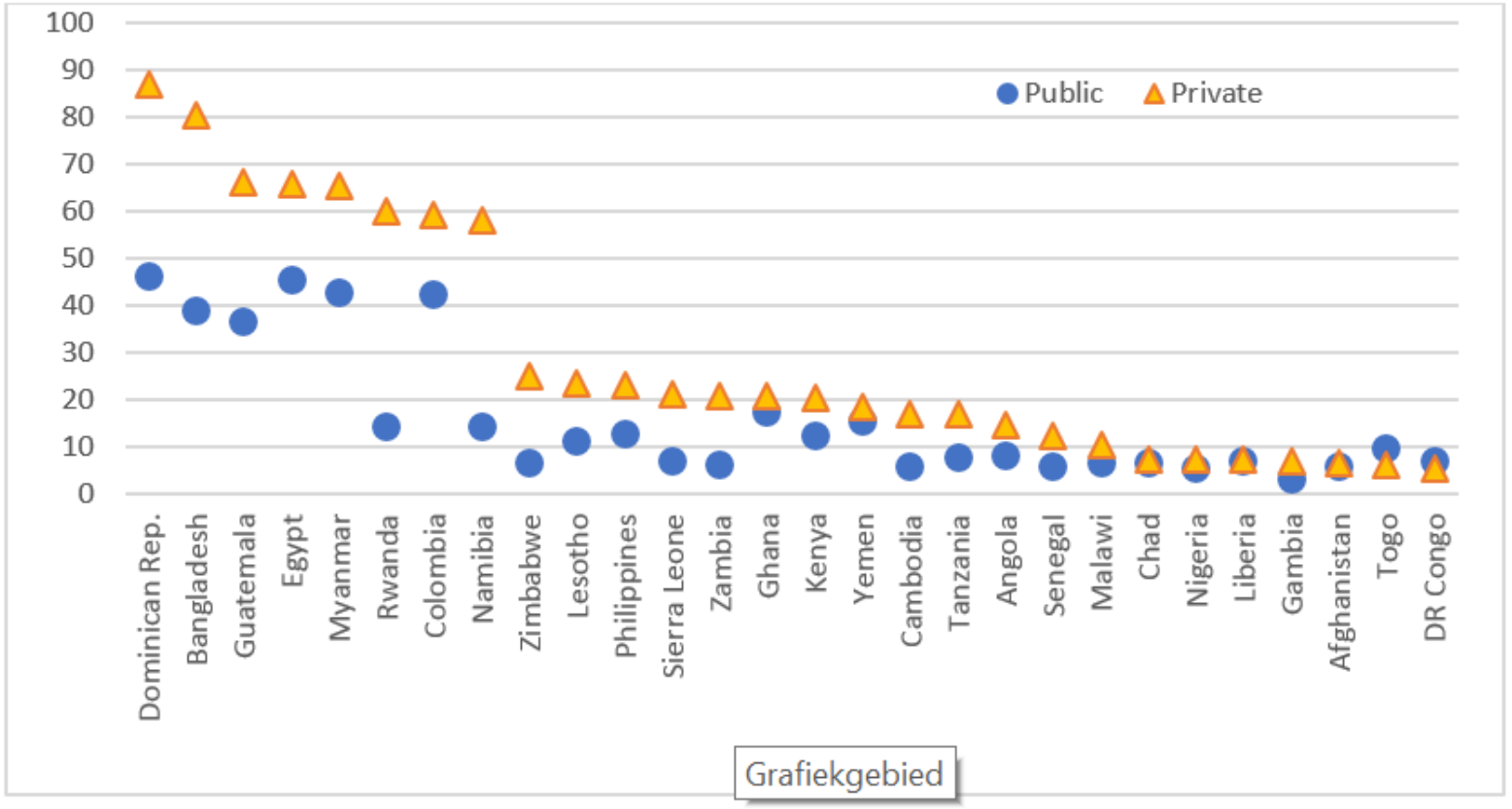


T.Boerma et al, subm

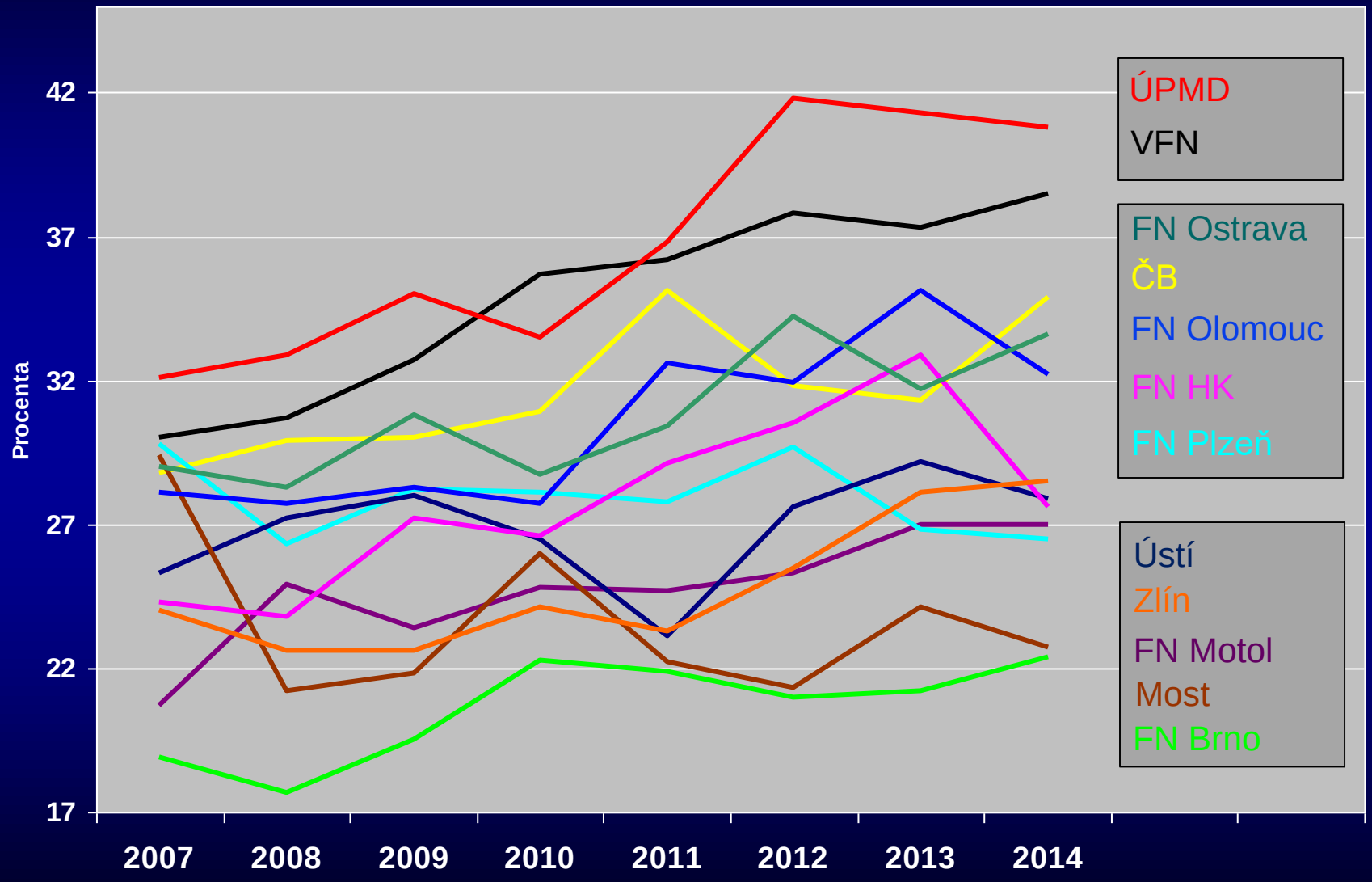
CS rates; public vs private

Figure 4: Caesarean section per 100 births in public and private-for-profit health facilities, selected countries with a DHS or MICS since 2013.



T.Boerma et al, subm

12 Perinatal Centres of the Czech Republic caesarean section rates 2007 - 2014



Source: Czech Society of Perinatology and Feto-Maternal Medicine

Velebil 2015

What should be the conclusion from these slides……

- The incidence of CSs has nothing to do with evidence based medicine.
- It has more to do with the doctor's salary, the lazy doctor who does not want to work at night, the doctor who has lost his/her skills to attend a (difficult) vaginal delivery
- Medical legal issues

Increase in CSs, increase in…

- direct maternal morbidity
- complications in subsequent pregnancies
- neonatal morbidity due to early delivery
- auto-immune and metabolic disease in the offspring

- no evidence for improved fetal outcome, for CS rates>10%

World Health Organization

WHO Statement on Caesarean Section Rates

Every effort should be made to provide caesarean sections to women in need, rather than striving to achieve a specific rate

2015

Caesarean section rates at the population level

WHO conducted two studies: a systematic review of available studies that had sought to find the ideal caesarean rate within a given country or population, and a worldwide country-level analysis using the latest available data. Based on this available data, and using internationally accepted methods to assess the evidence with the most appropriate analytical techniques, WHO concludes:

1. Caesarean sections are effective in saving maternal and infant lives, but only when they are required for medically indicated reasons.
2. At population level, caesarean section rates higher than 10% are not associated with reductions in maternal and newborn mortality rates.
3. Caesarean sections can cause significant and sometimes permanent complications, disability or death particularly in settings that lack the facilities and/or capacity to properly conduct safe surgery and treat surgical complications. Caesarean sections should ideally only be undertaken when medically necessary.
4. Every effort should be made to provide caesarean sections to women in need, rather than striving to achieve a specific rate.
5. The effects of caesarean section rates on other outcomes, such as maternal and perinatal morbidity, paediatric outcomes, and psychological or social well-being are still unclear. More research is needed to understand the health effects of caesarean section on immediate and future outcomes.

Caesarean section rates at the hospital level and the need for a universal classification system

There is currently no internationally accepted classification system for caesarean section that would allow meaningful and relevant comparisons of CS rates across different facilities, cities or regions. Among the existing systems used to classify caesarean sections, the 10-group classification (also known as the 'Robson classification') has in recent years become widely used in many countries. In 2014, WHO conducted a systematic review of the experience of users with the Robson classification to assess the pros and cons of its adoption, implementation and interpretation, and to identify barriers, facilitators and potential adaptations or modifications.

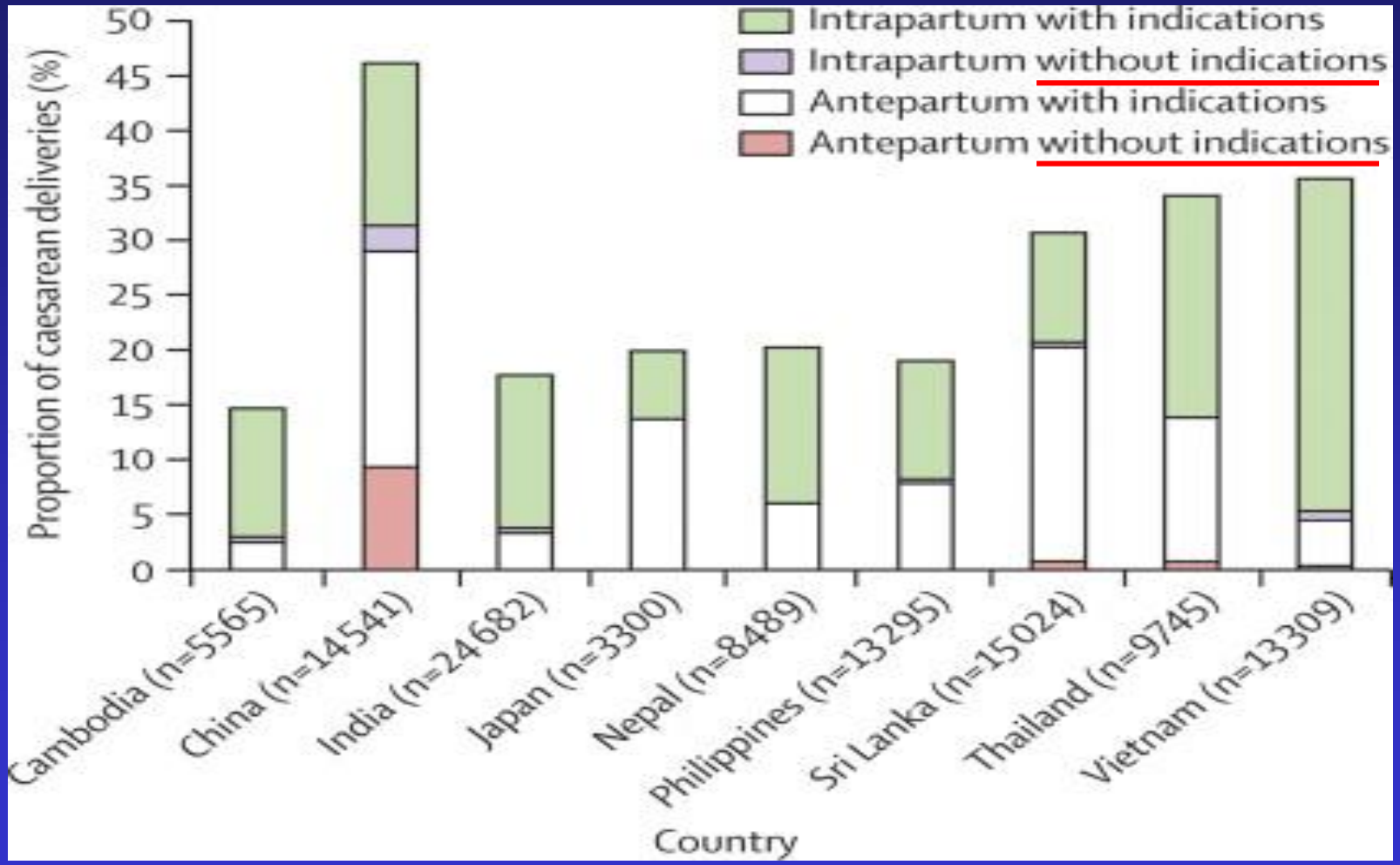
WHO proposes the Robson classification system as a global standard for assessing, monitoring and comparing caesarean section rates within healthcare facilities over time, and between facilities. In order to assist healthcare facilities in adopting the Robson classification, WHO will develop guidelines for its use, implementation and interpretation, including standardization of terms and definitions.

1

19% ?

G Molina et al, JAMA, Nov 2015

Caesarean Sections in Asia, 2007-08



Lumbiganon et al, Lancet, 2010;375:440-442

Caesarean Sections in Asia, 2007-08

Mat. mort, ICU admission, blood transfusion, hysterectomy, int iliac art ligation

	RR
Antepartum CS without indication	2.7 (1.4-5.5)
Intrapartum CS without indication	14.2 (9.8-20.7)

Lumbiganon et al, Lancet, 2010;375:440-442

CSs are dangerous in some parts of Africa

Table 6. Postpartum morbidity and mortality in women experiencing cesarean section or vaginal delivery in African vs. non-African sites, 2010–2015.

	African sites			Other sites		
Characteristic	CS	VD	RR (95% CI)	CS	VD	RR (95% CI)
Deliveries, *n*	1440	104 273		45 868	232 880	
Postpartum hemorrhage, %	6.1	3.0	1.9 (0.9–4.0)	1.2	2.1	0.8 (0.7–0.9)
Postpartum infection, %	3.9	0.4	8.7 (4.4–17.2)	1.0	0.6	1.6 (1.4–1.8)
Dilatation and curettage, %	11.0	3.8	3.3 (2.2–4.9)	8.4	5.8	1.2 (1.0–1.6)
Hysterectomy, %	1.7	0.1	15.0 (6.6–33.9)	0.2	0.0	2.5 (1.9–3.2)
Unplanned hospitalization, %	9.8	0.7	13.3 (9.7–18.3)	12.6	3.9	2.3 (2.1–2.6)
Maternal mortality <42 days, rate/100 000 deliveries	1469	93	13.6 (9.3–19.9)	193	98	1.9 (1.6–2.2)

Too late, inadequate infrastructure, inexperienced health care workers

Harrison et al, 2017

Placenta accreta,increta and percreta (and hysterectomy)

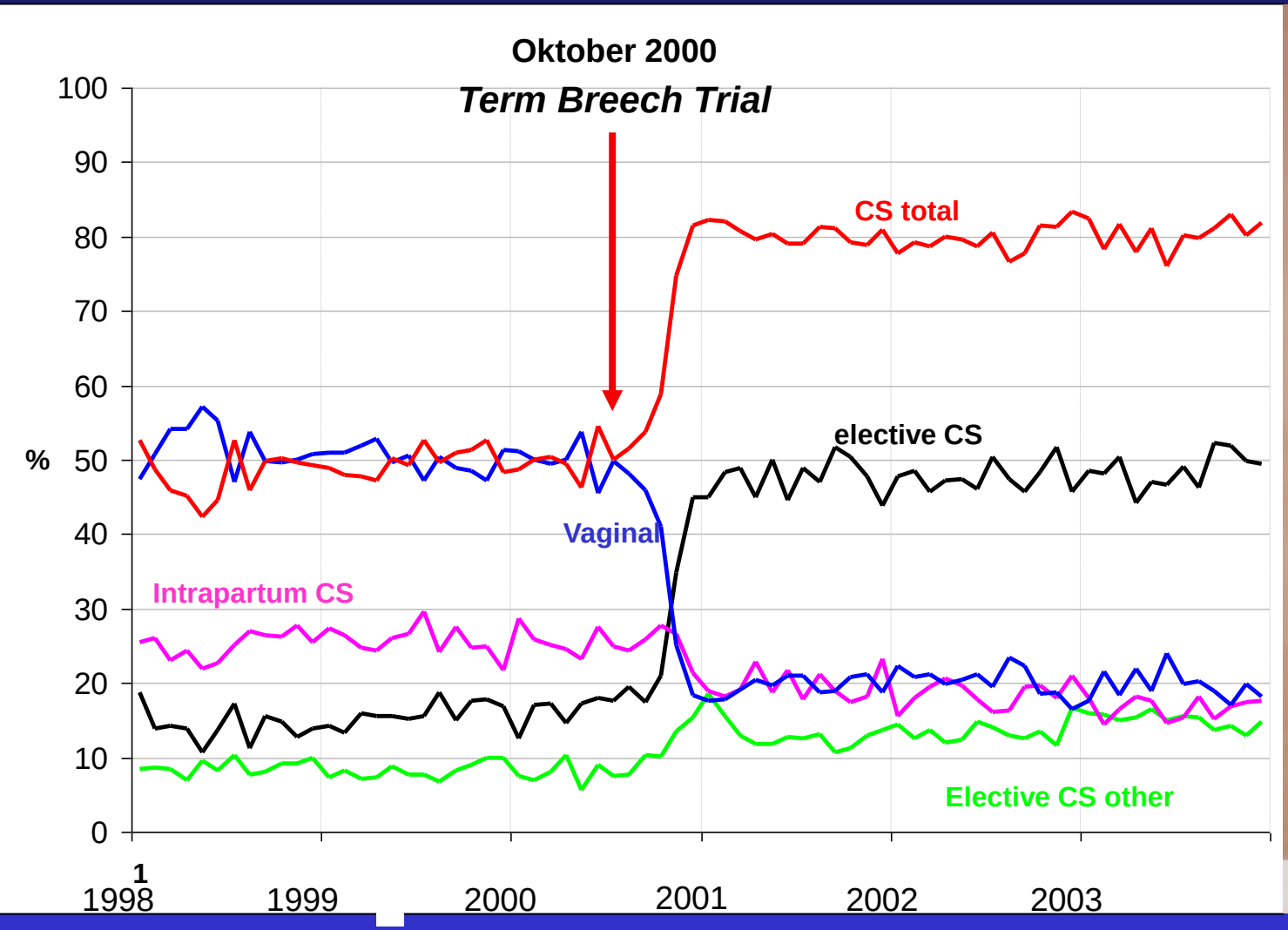
Number previous CS's	Total	Placenta AIP	Per 1000	
0		3	0,04	1:25000
1	4141	8	1.9	1:526
2	378	1	2.6	1:385
3	39	2	51.3	1:19
≥ 4	11	1	90.9	1:11

Kwee et al, Eur J Obstet Gyn, 2006

Moreover, a uterine rupture in 0.4 to 1% of subsequent pregnancies, with a perinatal death in 10% of cases

And an increase in infertility and spontaneous preterm delivery in subsequent pregnancies

More CS, better outcome?? No, only in breech deliveries



Data ‘Stichting PRN’

CS for breech position at follow up; mother versus infant

2000 SC | **11 infants**

1000 subsequent pregnancies:

- **10 uterine ruptures**
- **1 perinatal death** → **11 becomes 10**

1 uterine rupture for each infant 'saved'

(Kwee et al, 2005; Rietberg et al, 2005)

CS for breech position at follow up; mother versus infant

2000 SC → **11 infants**

1000 subsequent pregnancies:

- **10 uterine ruptures**
- **1 perinatal death** → **11 becomes 10**

1 uterine rupture for each infant 'saved'

- **3 hysterectomies (placenta increta, uterine rupture)**
- **4 % risk of 1 maternal death / peripartum hysterectomy**

And,
one maternal death for 80 infants that are "saved"

(Kwee et al, 2005; Rietberg et al, 2005)

Risks after CS in subsequent pregnancies in Low/middle income countries:

- **Will be much higher:**
- Given the large number of unattended deliveries, lack of transport, inadequate infra-structure and poor quality of roads
- Moreover, the fertility rate is generally high

Infant's death following maternal death

	RR infant death
Ethiopia; mat death<42d after delivery	46 (25.9-81.9)
Rural South Africa	15.2 (8.3-27.9)
Rural Tanzania, child death<10y:	5 40.7% versus 7.9%

Houle B et al; Finley JE et al; Moucheraud et al, Reprod. Health 2015

Progress in obstetrics

…….is more difficult to achieve than many of us believe/think

But in the meantime,……

- Many doctors have lost their skills to attend a vaginal breech or twin delivery……
- And ……

- Do the SC too early (<39wks)

Elective repeat CS and RDS, n=13.258

36 % performed before 39 weeks of gestation

		Odds ratio
37 wks		4.2 (2.7-6.6)
38 wks		2.1 (1.5-2.9)
39 wks	(reference)	
40 wks		1.1
41 wks		1.0
42 wks		2.3

Admission to NICU, newborn sepsis, treated hypoglycemia

Tita et al, NEJM 2009; MFM units network USA

So,

Never do an elective CS before 39 weeks of gestation, unless there is documentation of lung maturity

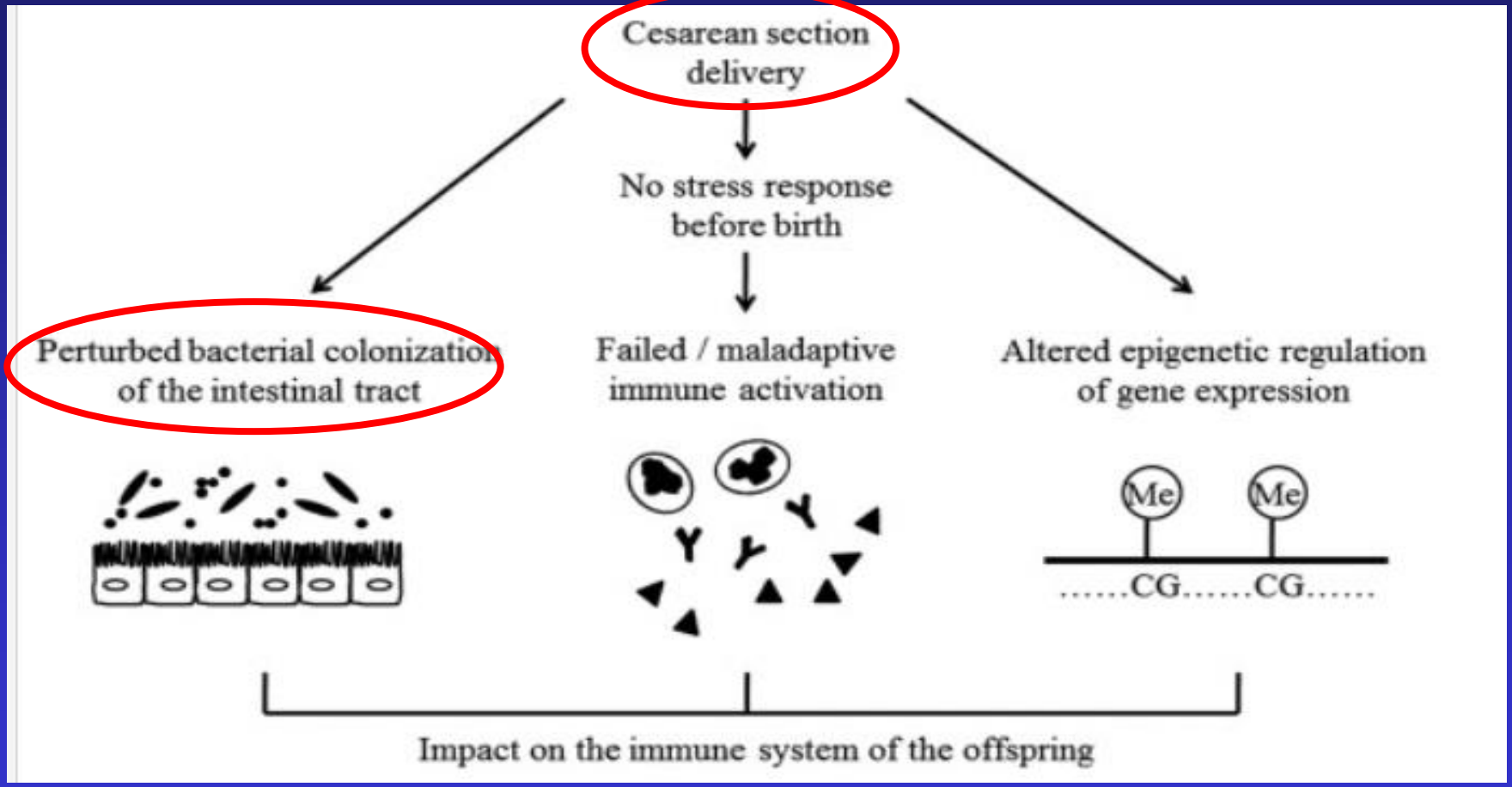
ACOG Committee Opinion no 394, December 2007, CS on maternal request

Effects CS on Immune response

- Childhood onset of type-1 diabetes
- Childhood asthma
- Childhood obesity
- Later risks for allergy
- Celiac disease
- Aseptic necrosis of femoral head
- Cancer in the young

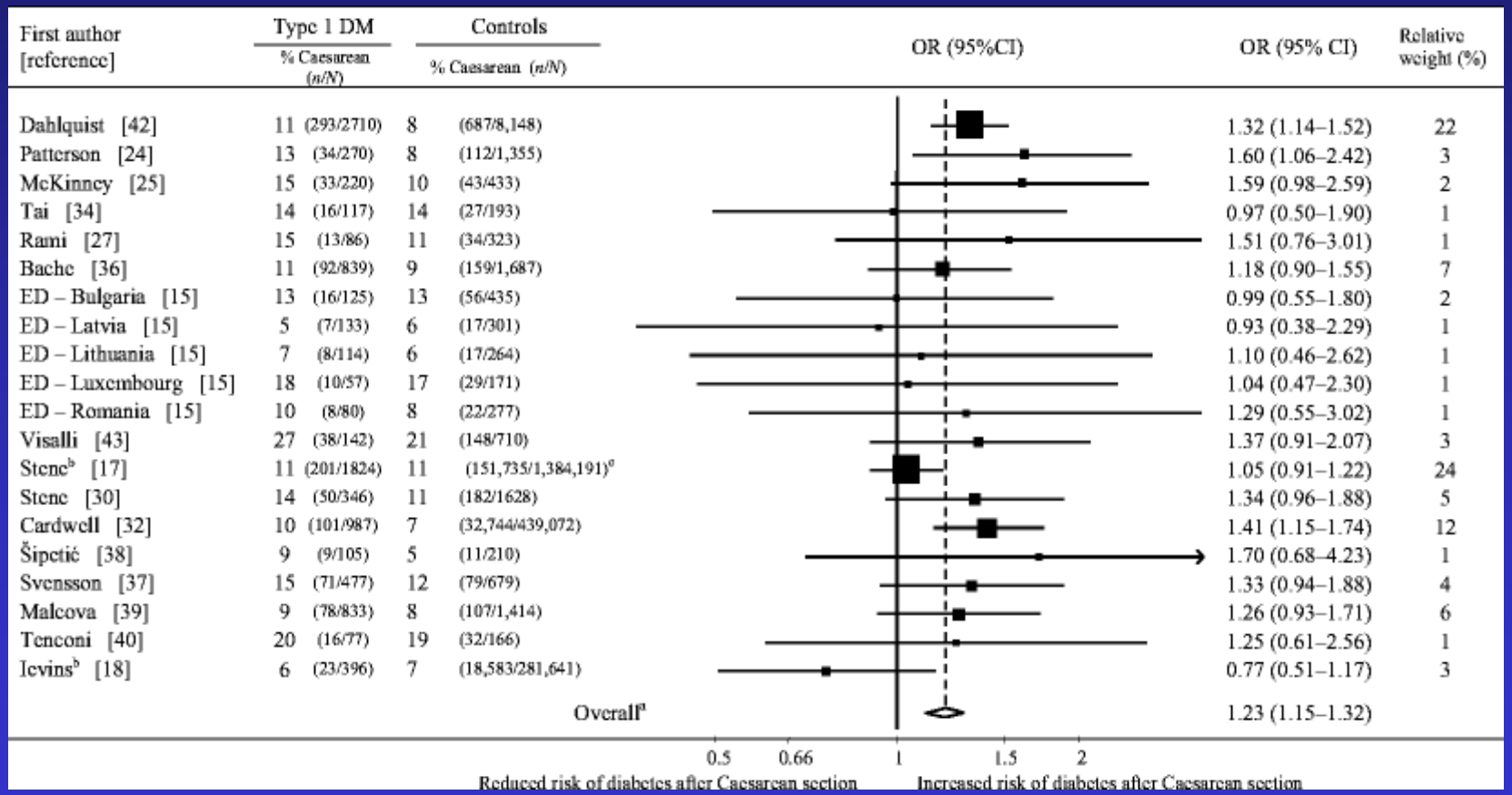
Cho & Norman, AJOG, 2012

Effects of CS on Immune response



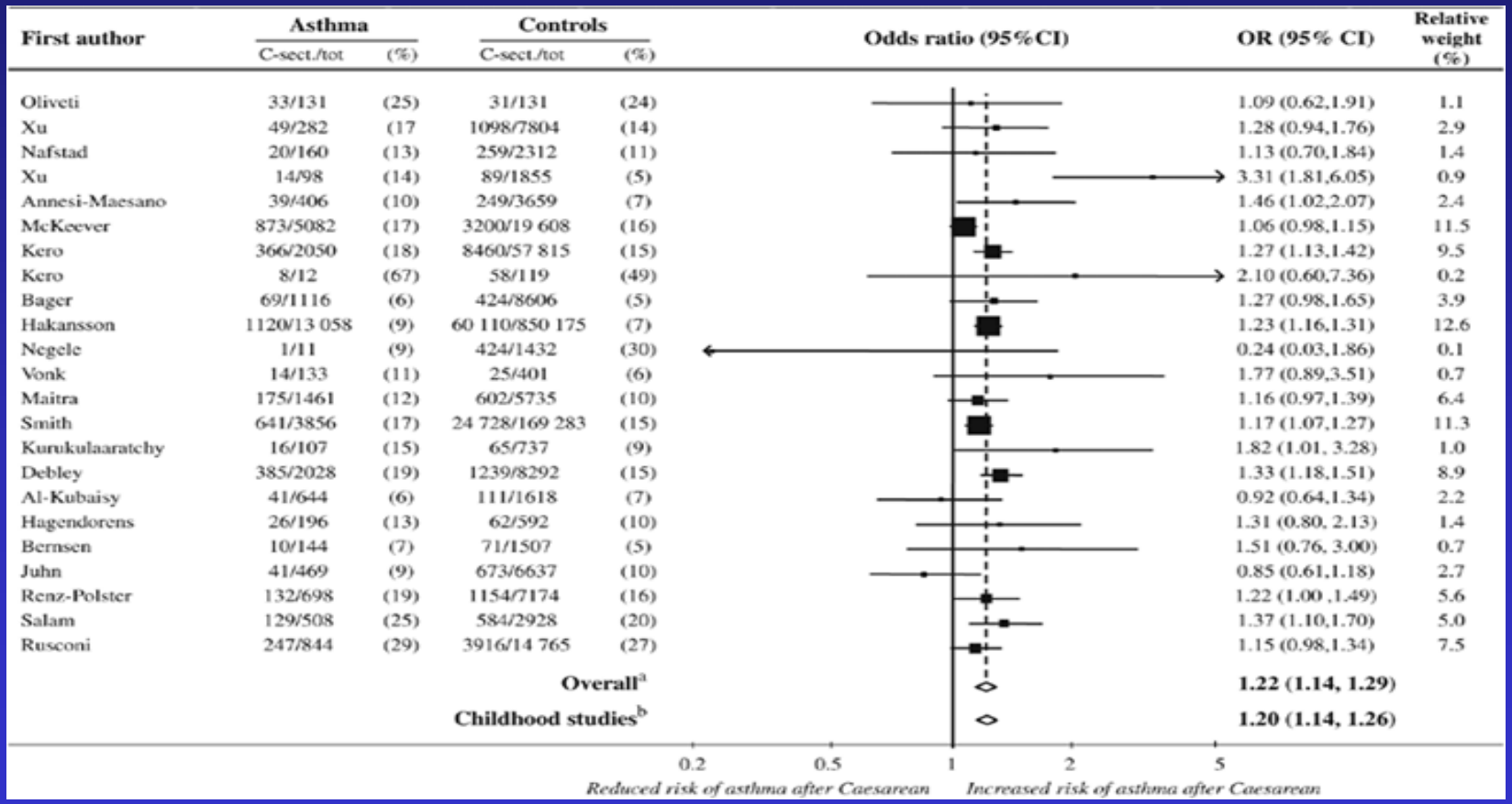
S.Koletzko, 2011; Cho & Norman, AJOG, 2012

CS is associated with a 23% increase in childhood-onset type-1-diabetes



Cardwell et al, Diabetologia 2008;51:726-735; meta-analysis of observational studies

CS is associated with a 20% increase in childhood asthma



First author	Asthma C-sect./tot	(%)	Controls C-sect./tot	(%)	OR (95% CI)	Relative weight (%)
Oliveti	33/131	(25)	31/131	(24)	1.09 (0.62,1.91)	1.1
Xu	49/282	(17	1098/7804	(14)	1.28 (0.94,1.76)	2.9
Nafstad	20/160	(13)	259/2312	(11)	1.13 (0.70,1.84)	1.4
Xu	14/98	(14)	89/1855	(5)	3.31 (1.81,6.05)	0.9
Annesi-Maesano	39/406	(10)	249/3659	(7)	1.46 (1.02,2.07)	2.4
McKeever	873/5082	(17)	3200/19 608	(16)	1.06 (0.98,1.15)	11.5
Kero	366/2050	(18)	8460/57 815	(15)	1.27 (1.13,1.42)	9.5
Kero	8/12	(67)	58/119	(49)	2.10 (0.60,7.36)	0.2
Bager	69/1116	(6)	424/8606	(5)	1.27 (0.98,1.65)	3.9
Hakansson	1120/13 058	(9)	60 110/850 175	(7)	1.23 (1.16,1.31)	12.6
Negele	1/11	(9)	424/1432	(30)	0.24 (0.03,1.86)	0.1
Vonk	14/133	(11)	25/401	(6)	1.77 (0.89,3.51)	0.7
Maitra	175/1461	(12)	602/5735	(10)	1.16 (0.97,1.39)	6.4
Smith	641/3856	(17)	24 728/169 283	(15)	1.17 (1.07,1.27)	11.3
Kurukulaaratchy	16/107	(15)	65/737	(9)	1.82 (1.01, 3.28)	1.0
Debley	385/2028	(19)	1239/8292	(15)	1.33 (1.18,1.51)	8.9
Al-Kubaisy	41/644	(6)	111/1618	(7)	0.92 (0.64,1.34)	2.2
Hagendorens	26/196	(13)	62/592	(10)	1.31 (0.80, 2.13)	1.4
Bernsen	10/144	(7)	71/1507	(5)	1.51 (0.76, 3.00)	0.7
Juhn	41/469	(9)	673/6637	(10)	0.85 (0.61,1.18)	2.7
Renz-Polster	132/698	(19)	1154/7174	(16)	1.22 (1.00 ,1.49)	5.6
Salam	129/508	(25)	584/2928	(20)	1.37 (1.10,1.70)	5.0
Rusconi	247/844	(29)	3916/14 765	(27)	1.15 (0.98,1.34)	7.5
			Overall[a]		**1.22 (1.14, 1.29)**	
			Childhood studies[b]		**1.20 (1.14, 1.26)**	

Thavagnanam et al Clin Exp Allergy 2007;38:629-633; meta-analysis of observational studies

CS is associated with a 20% increase in childhood asthma

Limitations:

Observational studies!

However, no clear effects of:

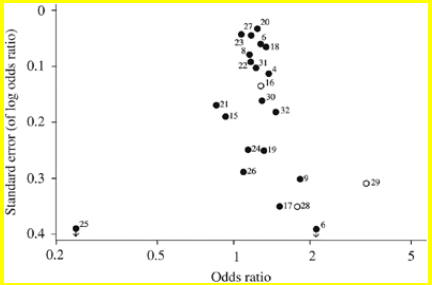
-low birth weight

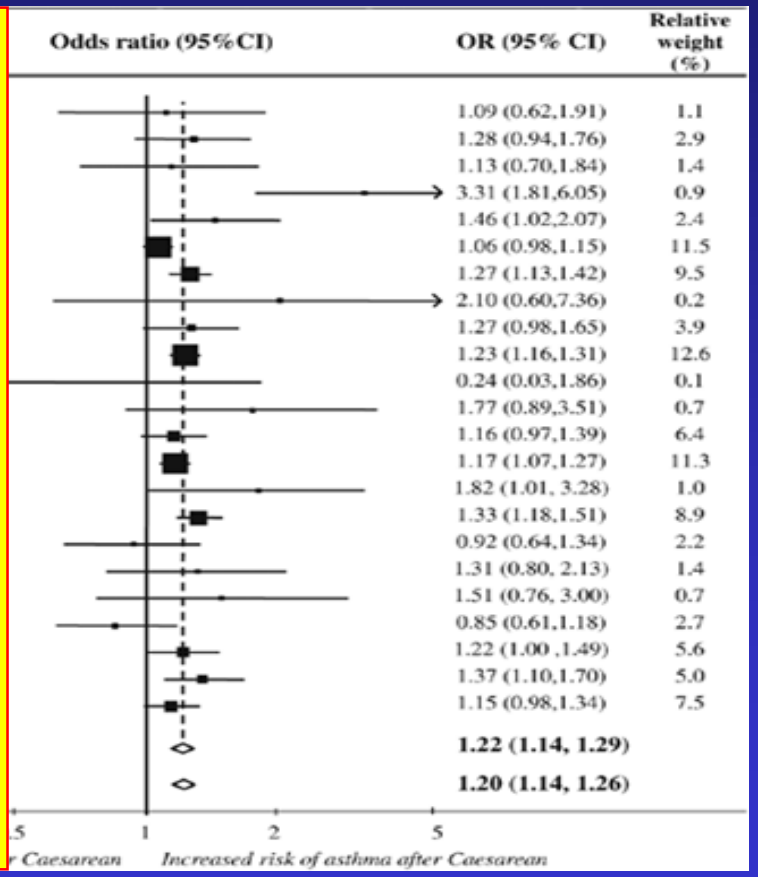
-breastfeeding

-passive smoking

No publication bias:

(funnel plot:)





Thavagnanam et al Clin Exp Allergy 2007;38:629-633; meta-analysis of observational studies

Cesarean Delivery and Obesity in offspring in later life

Meta-analysis, 15 studies n=163.753

Overweight OR 1.26 (1.16-1.38, p<0.00001)

Dharmaseelane et al , Modi 2014

ANALYSIS

Time to consider the risks of caesarean delivery for long term child health

Jan Blustein and **Jianmeng Liu** examine the evidence linking caesarean delivery with childhood chronic disease and say that guidelines on delivery should be reviewed with these risks in mind

Jan Blustein *professor* [1], Jianmeng Liu *professor* [2]

[1]New York University Wagner Graduate School and Departments of Population Health and Medicine, School of Medicine, New York, USA; [2]Institute of Reproductive and Child Health/Ministry of Health Key Laboratory of Reproductive Health and Department of Epidemiology and Biostatistics, Peking University School of Public Health, Beijing, China

Caesarean delivery can improve maternal and child health, and even save lives. But the past two decades have brought a sharp growth in caesareans in many nations, raising concerns about unnecessarily high rates. Caesarean delivery on maternal request is relatively rare in the UK (1-2% of births) and US (3% of births). But in some middle income countries the rate is high and growing (20% of births in southeastern China in 2006), making it an emerging global public health concern. Another contributor to the rising rates is repeat caesarean. Although this is not necessarily medically indicated in women with otherwise

association with type 1 diabetes (based on 20 studies),[2] asthma (23 studies),[3] and obesity (nine studies).[4] We did not find any meta-analyses that reported no association with these outcomes.

The combined cohort and case-control evidence for type 1 diabetes is particularly compelling because many of the studies used detailed sets of well characterised clinical confounders (birth weight, gestational age, maternal age, birth order, maternal diabetes, and breast feeding). Authors of the meta-analysis were able to assemble individual patient data from most component studies and calculate a pooled risk estimate, adjusting for known

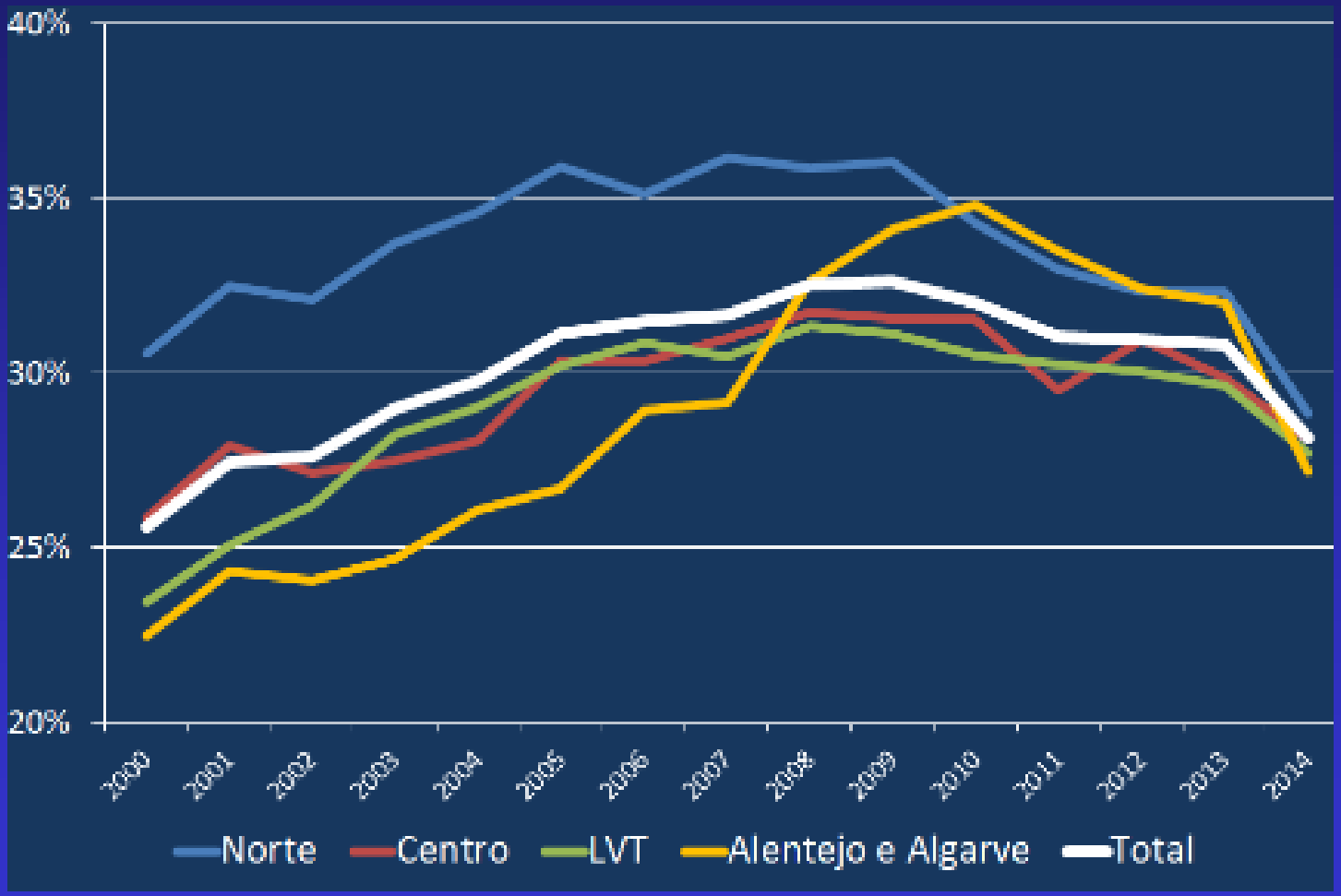
Lancet Mini series, October 2018

- The global epidemiology / pandemic of Caesarean Sections
- Short and long-term impacts/or effects of Caesarean Section on the health of women and children
- Interventions to reduce unnecessary caesareans for term, healthy women and babies: what works and why?
- FIGO Position paper: How to stop the Cesarean section Epidemic. SMNH Committee
- Call to action to reverse the caesarean section pandemic; commentary Marleen Temmerman, Gerard HA Visser, Franka Cadée, Susan A Papp

FIGO position paper

- Doctor's fee for Ces Section, similar to that of vaginal delivery
- Financing of hospitals partly be based on CS rate
- Use uniform CS classification system (Robson)
- Women should be informed properly about risks and benefits of CS
- Invest in better care and support, privacy, adequate pain relief
- Improve training and reintroduce vaginal instrumental deliveries

How the Portugese bring their CS rate down



Ayres-de-Campos et al, 2015

Iran

No effect:
Mother-friendly hosp
Standard protocols
Preparation classes
Work shops

CD rate:

2000	**35%**
2005	**41%**
2014	**48%**

Sabet et al, Lancet July 2, 2016

2014 initiative:
- Nat child birth free of charge in all gouv hosp
- Improved privacy in labour wards
- Adequate pain relief
- Financial incentives promoting nat child birth
- CD rate affects hospital rating

Iran

No effect:
Mother-friendly hosp
Standard protocols
Preparation classes
Work shops

CD rate:

2000	**35%**
2005	**41%**
2014	**48%**

Sabet et al, Lancet July 2, 2016

2014 initiative:

Effect:
10% reduction in CD rate in 15 months

BJOG An International Journal of Obstetrics and Gynaecology

DOI: 10.1111/1471-0528.14057
www.bjog.org

Epidemiology

Lowering the high rate of caesarean delivery in China: an experience from Shanghai

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Accepted 8 February 2016. Published online 13 May 2016.

Reduction CS from 52 to 36%

Objective To examine the trends of caesarean delivery (CD) after an intervention to lower the high rate of CD at a Chinese maternity hospital.

Design Retrospective cohort study.

Setting A large tertiary obstetric centre in Shanghai, China, from 2007 to 2014.

Sample 81 459 nulliparous women who delivered a term singleton infant.

Methods Logistic regression was used to calculate the odds of CD while adjusting for confounders.

Main outcome measure Rate of CD before and after the intervention.

antepartum CD (OR: 0.67, 95% CI: 0.64–0.69). The frequencies of perinatal mortality (0.5 versus 0.4/1000), hypoxic ischaemic encephalopathy (0.9 versus 1.2/1000), meconium aspiration syndrome (0.5/1000), birth trauma (0.6/1000), respiratory distress syndrome (0.5% versus 0.4%) and necrotising enterocolitis (0.9 versus 0.6/1000) were similar. The frequency of neonatal infection increased slightly (0.6% versus 0.8%), although this could be explained by other factors.

Conclusions A marked reduction in CD has occurred at an urban tertiary care centre as a result of efforts to reduce the high rate of caesarean delivery. No notable differences in neonatal outcomes were observed.

Keywords Caesarean delivery, China, pregnancy, quality improvement

DOI: 10.1111/1471-0528.14057
www.bjog.org

Lowering the high rate of caesarean delivery in China: an experience from Shanghai

X Liu,[a] CD Lynch,[b] WW Cheng,[a] MB Landon[b]

How??

- **Education**
- **Support**
- **Adequate pain relief**
- **And…..change in the reimbursement model for doctors and hospitals**

So,……..

- Please reconsider your high CS rate; involve the gouverment and health care insurance companies
- Is likely to increase direct and late maternal risks
- And to impair long term outcome in their offspring

THANK YOU

In an era of technology we should not forget, that

Care is more important than Cure

How to bring the CS rate down?

- Increase the doctor's fee of a vaginal delivery and bring the CS fee down to half of that
- Have a companion present during the whole process of labour (care versus cure;'Doula')
- Re-establish adequate knowledge and practical skills of the doctors*
- Confidence to the women
- Medico-legal

* Training shoulder dystocia results in a 3-fold decrease in brachial nerve injury; Inglis et al, AJOG 2011

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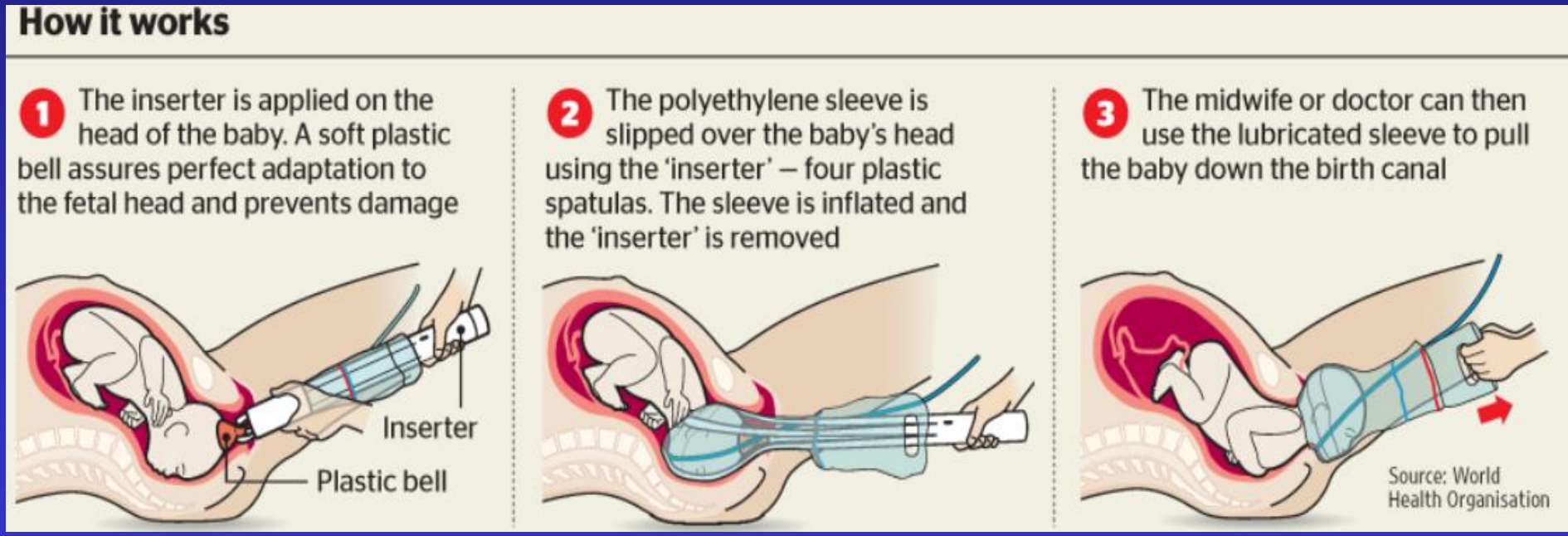
Doctors do not use Vacuum or Forceps extractions anymore… an alternative

The ODON device



Thank you

How the Portugese are bringing their CS rate down? (D.Ayres-de-Campo)

- Dissimination of knowledge
- Uniform CS classification system
- Publication of annual CS rate/hospital
- Payment of CS= vaginal delivery **
- Financing of hospitals based on CS rate
- Implementation of STAN technology

- **(initially) not accepted by private sector

How to lower the CS rate?

- 6- The situation in very low-income countries requires specific attention, considering that access to CSs is still insufficient in rural areas, whereas CSs seem to rise inappropriately in some of the urban areas and can be associated with substantial maternal morbidity and mortality (8,13). Both situations are unwanted. In rural areas adequate access to skilled care, to appropriate fetal surveillance and to assisted births/operative delivery is essential

How to lower the CS rate?

FIGO position paper

- 1- The delivery fees for physicians for undertaking CS and attending vaginal delivery should be the same using a mean. This should also happen in private practice settings.
- 2- Hospitals should be obliged to publish annual CS rates, and financing of hospitals should partly be based on CS rates. Risk adjusted CS rates should become available.
- 3- Hospitals should use a uniform classification system for CSs (Robson/WHO classification; (1,12)).

How to lower the CS rate?

- 4- Women should be informed properly on the benefits and risks of a CS
- 5- Money that will become available from lowering CS costs should be invested in, resources, better preparation for labour and delivery and better care, adequate pain relief, practical skills' training for doctors and midwives and reintroduction of vaginal instrumental deliveries to reduce the need for CS in the second stage of labour.

Summary FIGO position paper

Worldwide there is an alarming increase in cesarean section (CS) rates. The medical profession on its own cannot reverse this trend. Joint actions with governmental bodies, the health care insurance industry and women's groups are urgently needed to stop unnecessary CSs and enable women and families to be confident of receiving the most appropriate obstetric care for their individual circumstances.

Endorsed by Int Confederation of Midwives and Action Group Women Deliver

CSs are dangerous in some parts of Africa

Table 6. Postpartum morbidity and mortality in women experiencing cesarean section or vaginal delivery in African vs. non-African sites, 2010–2015.

	African sites			Other sites		
Characteristic	CS	VD	RR (95% CI)	CS	VD	RR (95% CI)
Deliveries, *n*	1440	104 273		45 868	232 880	
Postpartum hemorrhage, %	6.1	3.0	1.9 (0.9–4.0)	1.2	2.1	0.8 (0.7–0.9)
Postpartum infection, %	3.9	0.4	8.7 (4.4–17.2)	1.0	0.6	1.6 (1.4–1.8)
Dilatation and curettage, %	11.0	3.8	3.3 (2.2–4.9)	8.4	5.8	1.2 (1.0–1.6)
Hysterectomy, %	1.7	0.1	15.0 (6.6–33.9)	0.2	0.0	2.5 (1.9–3.2)
Unplanned hospitalization, %	9.8	0.7	13.3 (9.7–18.3)	12.6	3.9	2.3 (2.1–2.6)
Maternal mortality <42 days, rate/100 000 deliveries	1469	93	13.6 (9.3–19.9)	193	98	1.9 (1.6–2.2)

CS, cesarean section; RR, relative risk; VD, vaginal delivery.

Harrison et al, 2017