



# Zwangerschap: De fietsproef voor een 'gezond' leven?

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Afdeling Verloskunde

Erasmus MC, Rotterdam

# Fietstest



- **Wat gebeurt er allemaal tijdens de zwangerschap?**
- **Hoe veilig is zwangerschap?**
- **Wat betekent een zwangerschapscomplicatie voor de gezondheid op lange termijn?**
- **Kunnen we iets voorkomen?**
- **Hoe moet de follow-up eruit zien?**



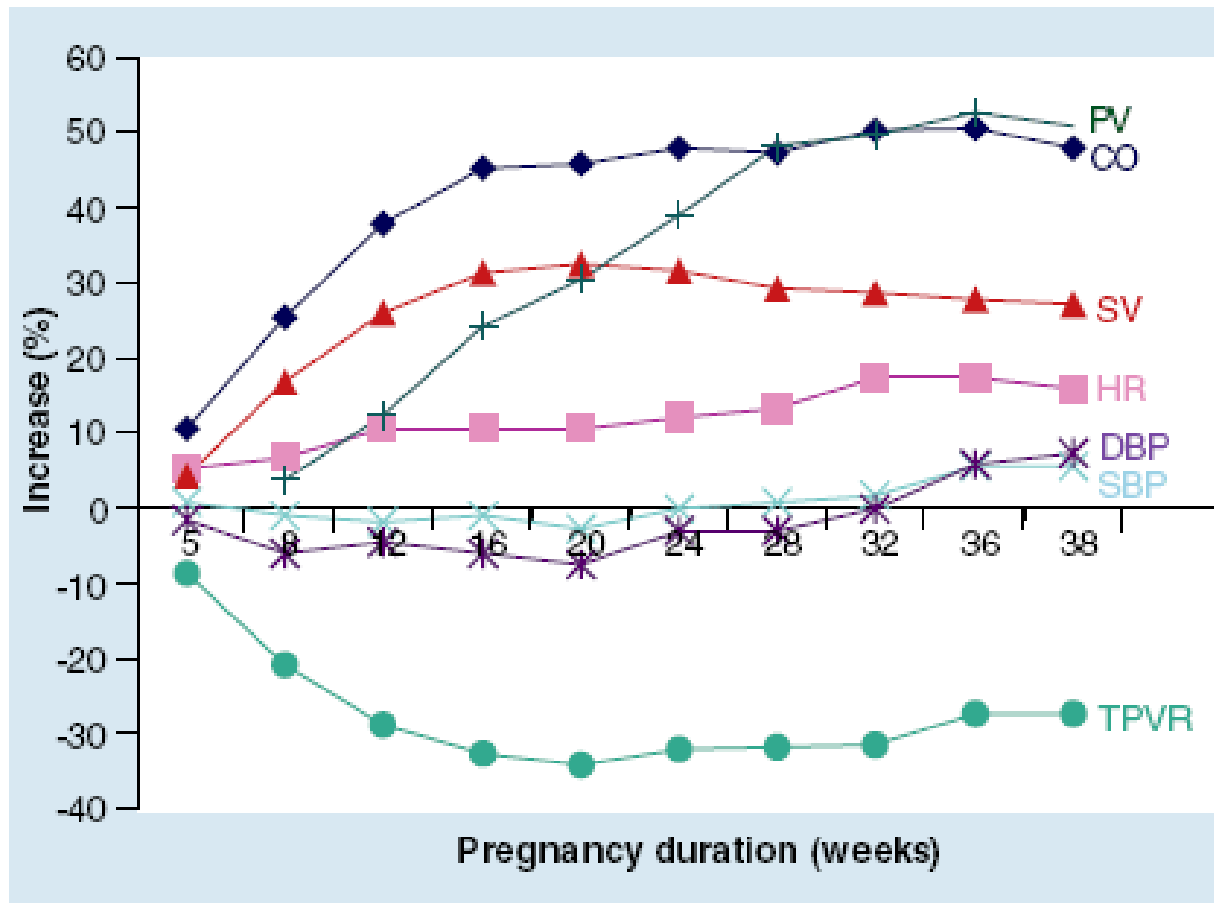
# Wat gebeurt er allemaal?



## Wat gebeurt er allemaal?

Parameter	Percentage of change	
Cardiac output	40–50%	Increase
Stroke volume	30%	Increase
Heart rate	15–25%	Increase
Intravascular volume	45%	Increase
Systemic vascular resistance	20%	Decrease
Systolic BP		Minimal
Diastolic BP	20%	Decrease at mid-pregnancy Pre-pregnant values at term
CVP		Unchanged
O <sub>2</sub> consumption	30–40%	Increase

# Haemodynamische veranderingen tijdens de ongecompliceerde zwangerschap

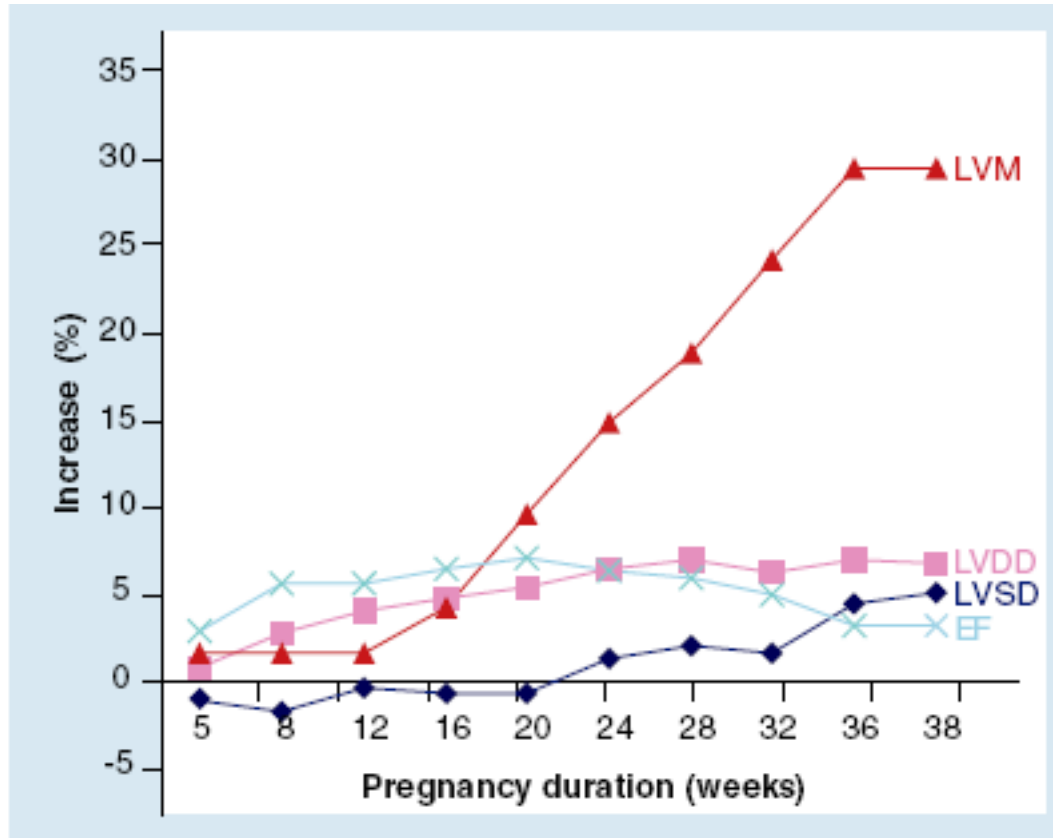


CO: Cardiac output; DBP: Diastolic blood pressure; HR: Heart rate; PV: Plasma volume; SBP: Systolic blood pressure; SV: Stroke volume; TPVR: Total peripheral vascular resistance.

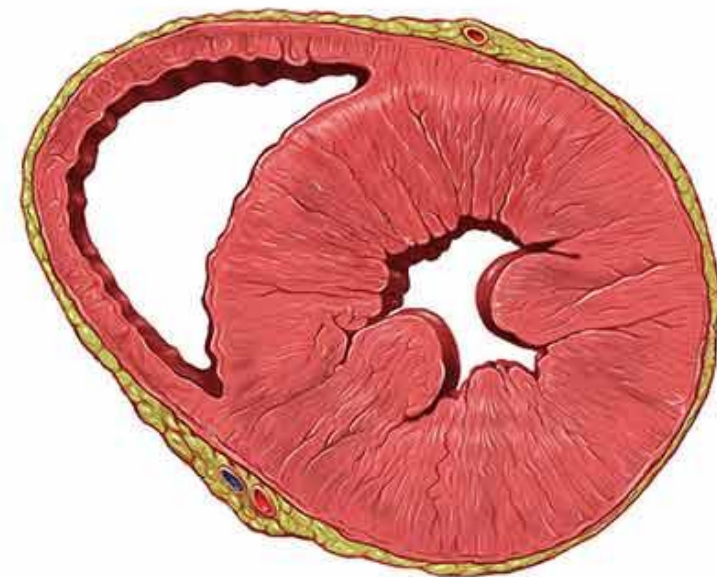
Taken from [3,6].



# Cardiac remodelling



EF: Ejection fraction; LVDD: Left ventricular diastolic dimension;  
 LVM: Left ventricular mass index; LVSD: Left ventricular systolic dimension.  
 Taken from [5,6].



# Plasma volume tijdens de zwangerschap

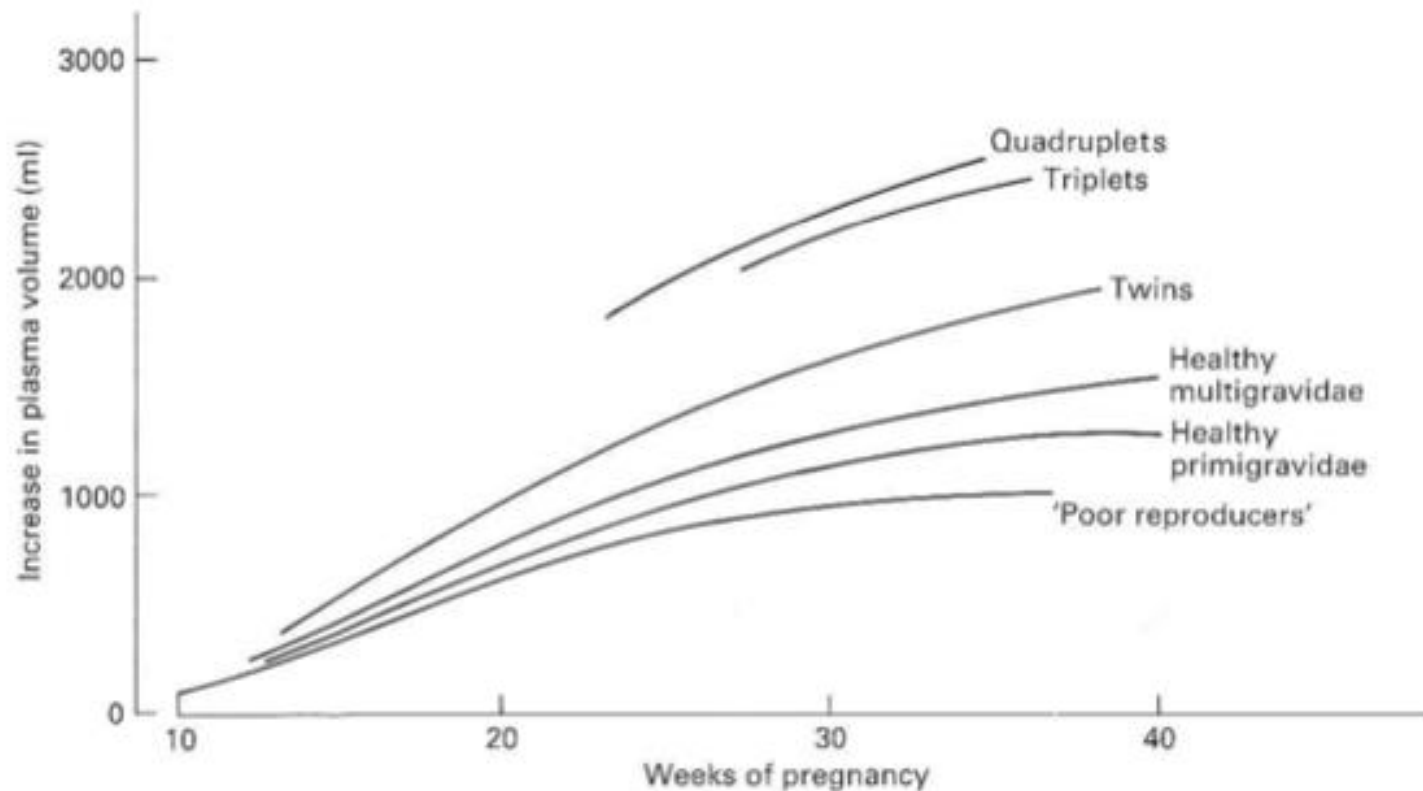


Fig. 2.2. Plasma volume in single and multiple pregnancies.



# Wat gebeurt er verder?

- **Lipiden: stijging cholesterol, triglyceriden, daling LDL, stijging HDL**
- **Insuline resistentie**
- **Toename vetweefsel**
- **(Metabool syndroom)**



## Barker hypothese



### BARKER HYPOTHESIS

- Undernutrition at different stages of pregnancy, and in infancy leads to increased risk of
  - Cardiovascular disease
  - Hypertension
  - Diabetes mellitus
  - Abnormal cholesterol levels
  - Abnormal coagulation factors

# Een “natuurlijk” experiment: de hongerwinter

- Maternaal gewicht 68 naar 62 kg
- Duur: 7 maanden
- Van  $\pm 1800$  kcal naar  $\pm 700$  kcal
- Geboortegewicht: 300 gram minder
- Late ondervoeding geeft alleen gewichtsverlies, niet in eerste trimester



IJE vol.33 no.4 © International Epidemiological Association 2004; all rights reserved.  
Advance Access publication 27 May 2004

*International Journal of Epidemiology* 2004;33:831–836  
doi:10.1093/ije/dyh083

## Intrauterine famine exposure and body proportions at birth: the Dutch Hunger Winter

Aryeh D Stein,<sup>1</sup> Patricia A Zybert,<sup>2</sup> Margot van de Bor<sup>3</sup> and LH Lumey<sup>2</sup>



## De hongerwinter: effecten op het nageslacht

- **Hele graviditeit: diabetes mellitus**
- **Vooraf eerste trimester: hart- en vaatziekten, overgewicht, psychiatrische aandoeningen, borstkanker**
- **Vooraf tweede/derde trimester: longaandoeningen, nierziekten**

De effecten van honger zijn afhankelijk van de timing tijdens de zwangerschap

VROEG



suikerziekte  
overgewicht  
hart- en vaatziekten  
veroudering  
borstkanker  
voedselvoorkeur  
depressie  
stress gevoeligheid  
stolling  
cholesterol  
schizofrenie  
veroudering

MIDDEN



suikerziekte  
longziekten  
nierziekten

LAAT



suikerziekte



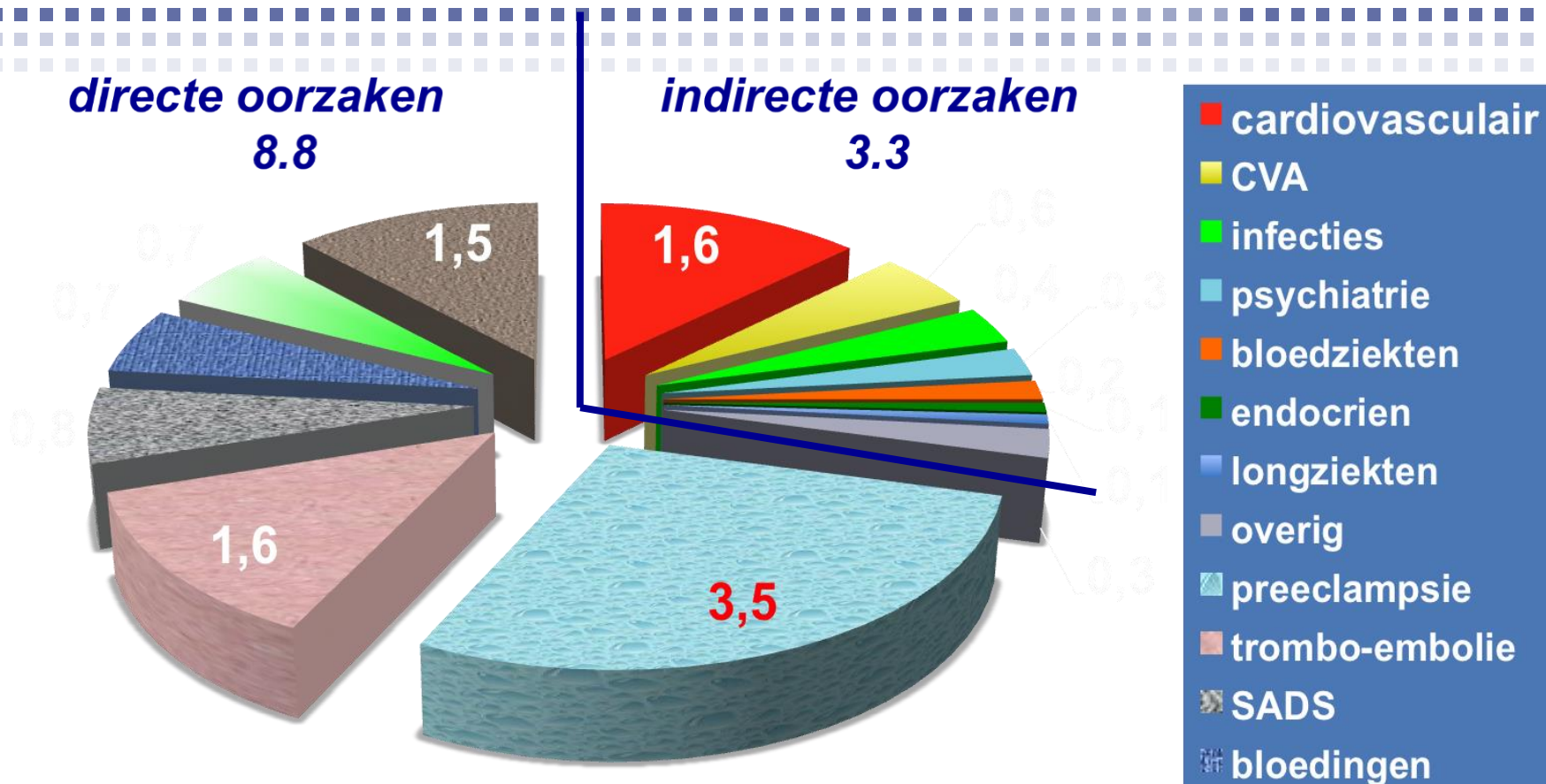
# Verloop moedersterfte in Nederland

## VROUWENSTERFTE TIJDENS ZWANGERSCHAP OF BEVALLING

De kans dat vrouwen tijdens de zwangerschap of bevalling overlijden is sinds de helft van de twintigste eeuw meer dan tien keer zo klein geworden. Vanaf 2007 sterven minder dan tien vrouwen (per 100.000 levendgeboren kinderen) per jaar tijdens zwangerschap of bevalling.



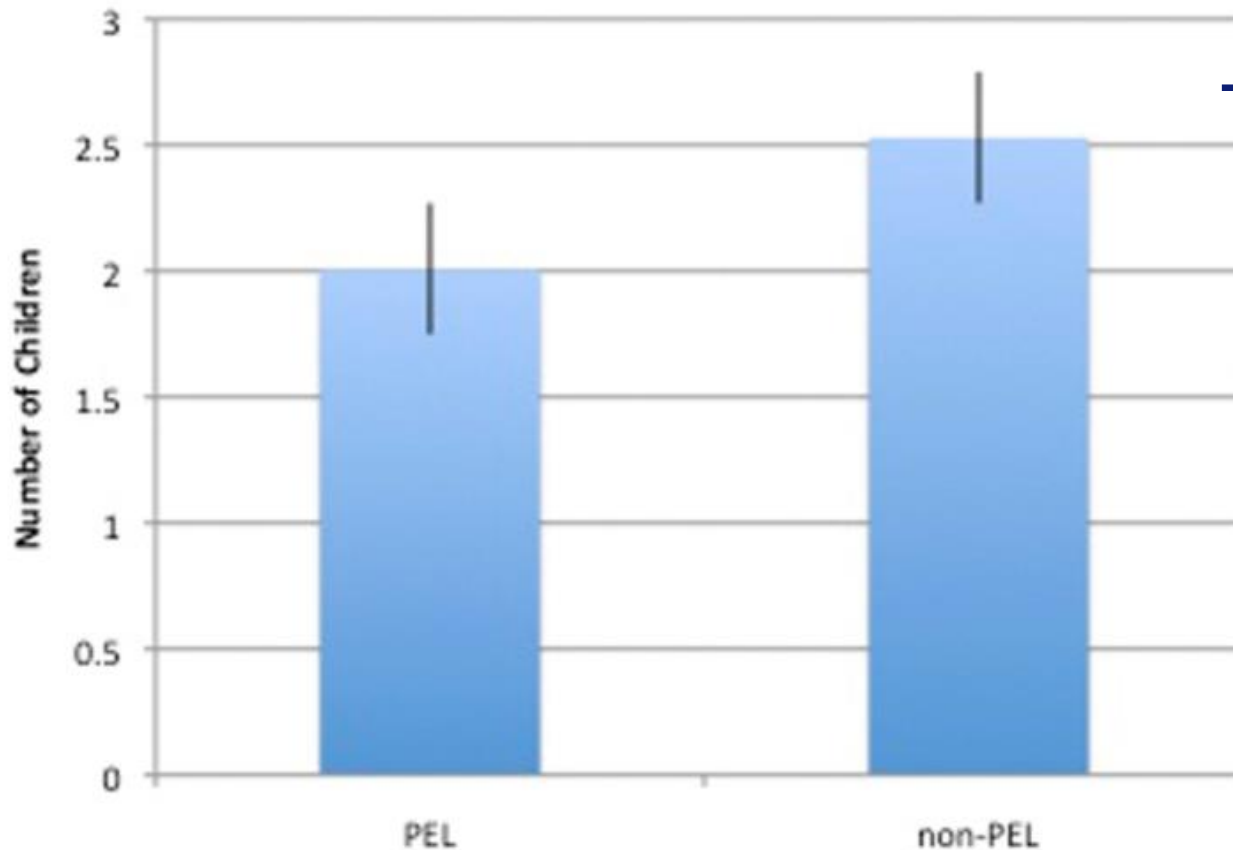
# Maternale sterfte 1993-2005 in Nederland



**Maternal Mortality Ratio = aantal overleden moeders per 100.000 levend geboren**



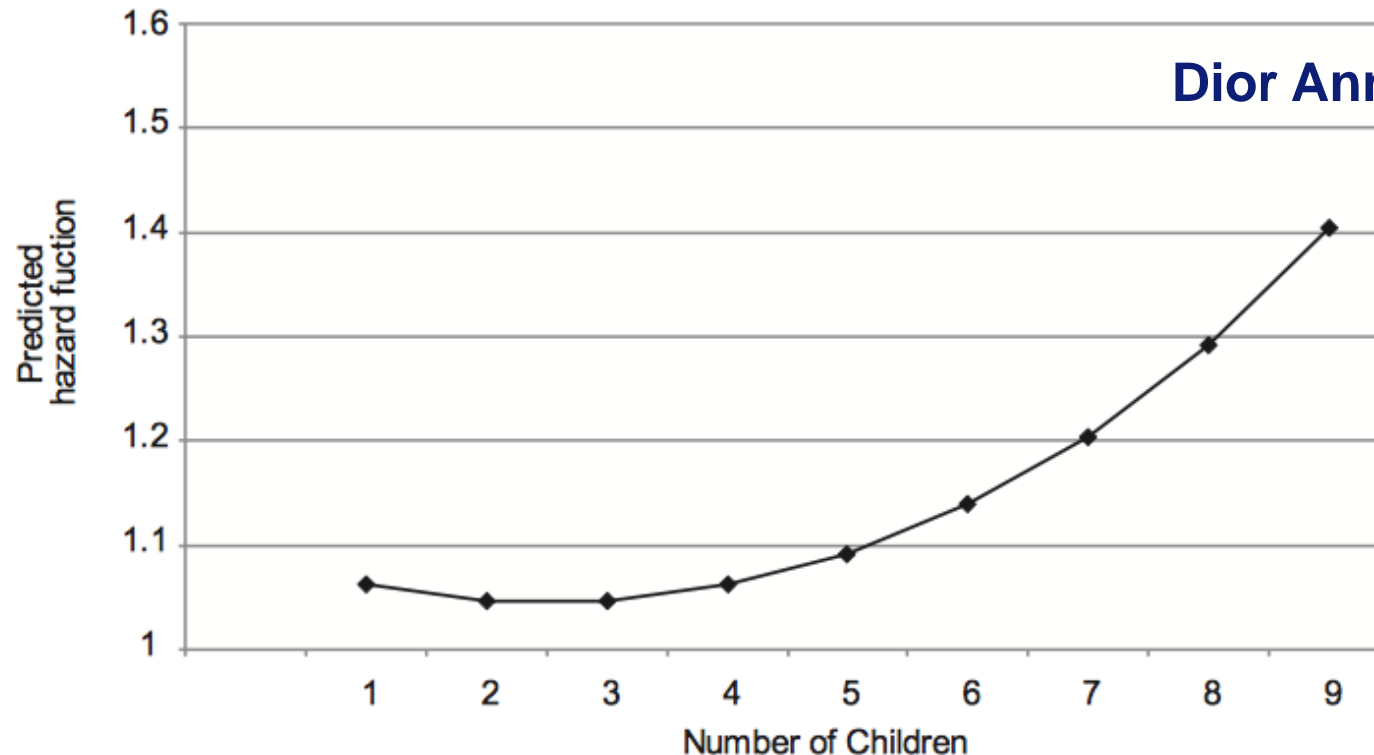
## Is zwangerschap sowieso niet gevaarlijk?



Tabatabaie Aging 2011

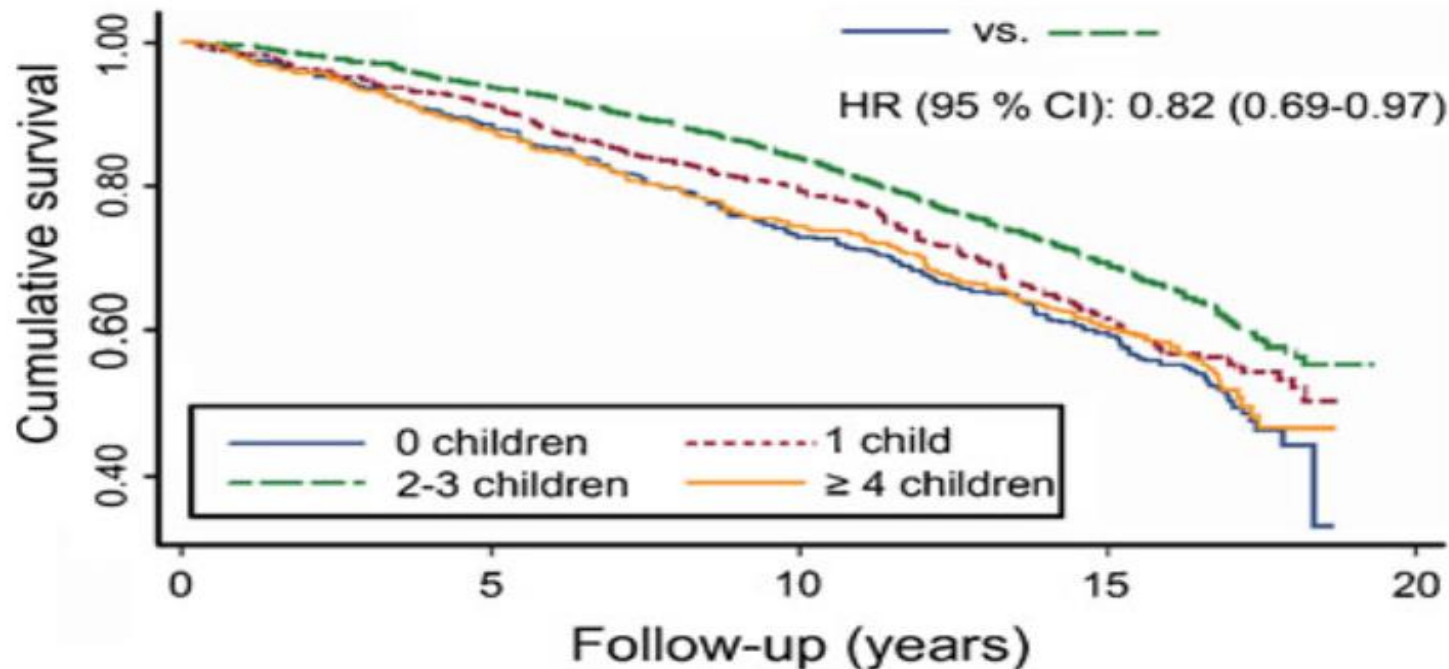
**Figure 1.** The number of children born to people with exceptional longevity (PEL) and a non-PEL control group.

# Is zwangerschap sowieso niet gevaarlijk?



**Fig. 1.** Association between number of children (N) and total mortality in mothers: A continuous model. Adjusted for mother's age at first birth, mother's origin, socioeconomic status, diabetes mellitus, gestational diabetes mellitus, toxemia, hypertension, smoking, multiple pregnancies, and Cesarean sections.

## Is zwangerschap sowieso niet gevaarlijk?



**Fig. 1** Kaplan–Meier survival curves for women with different numbers of children. The hazard ratio (HR) with 95% confidence interval (CI) for the comparison of women with no children and women with two to three children is adjusted for age at baseline and education

# Wat zijn de zwangerschapscomplicaties?

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# Sterfte na preeclampsie



**Table III.** Remote deaths in women surviving eclampsia

	<i>White primiparas</i>	<i>White multiparas</i>	<i>Black primiparas</i>	<i>Black multiparas</i>
No. surviving eclampsia	187	59	19	5
No. traced to 1973-74	185	59	18	5
Remote deaths:				
Number	31	33	7	5
Percentage	16.6	56	36.8	100
Deaths in cardiovascular field:				
Number	9	27	4	3*
Percentage of deaths	29	82	57	60
Patient-years of follow-up	6,067	1,554	508.5	109
Average annual death rate per 1,000	5.11	21.3	13.8	45.8
Expected deaths	25.7	11.6	2.8	0.8
Ratio of actual/expected deaths	1.19	2.75	2.3	5.0
P	0.4†	0.001†	0.03‡	0.004‡
Mean years of follow-up, all cases	32.5	26.3	26.8	21.8
Mean years of follow-up of those still alive	33.5	31.9	32.3	—

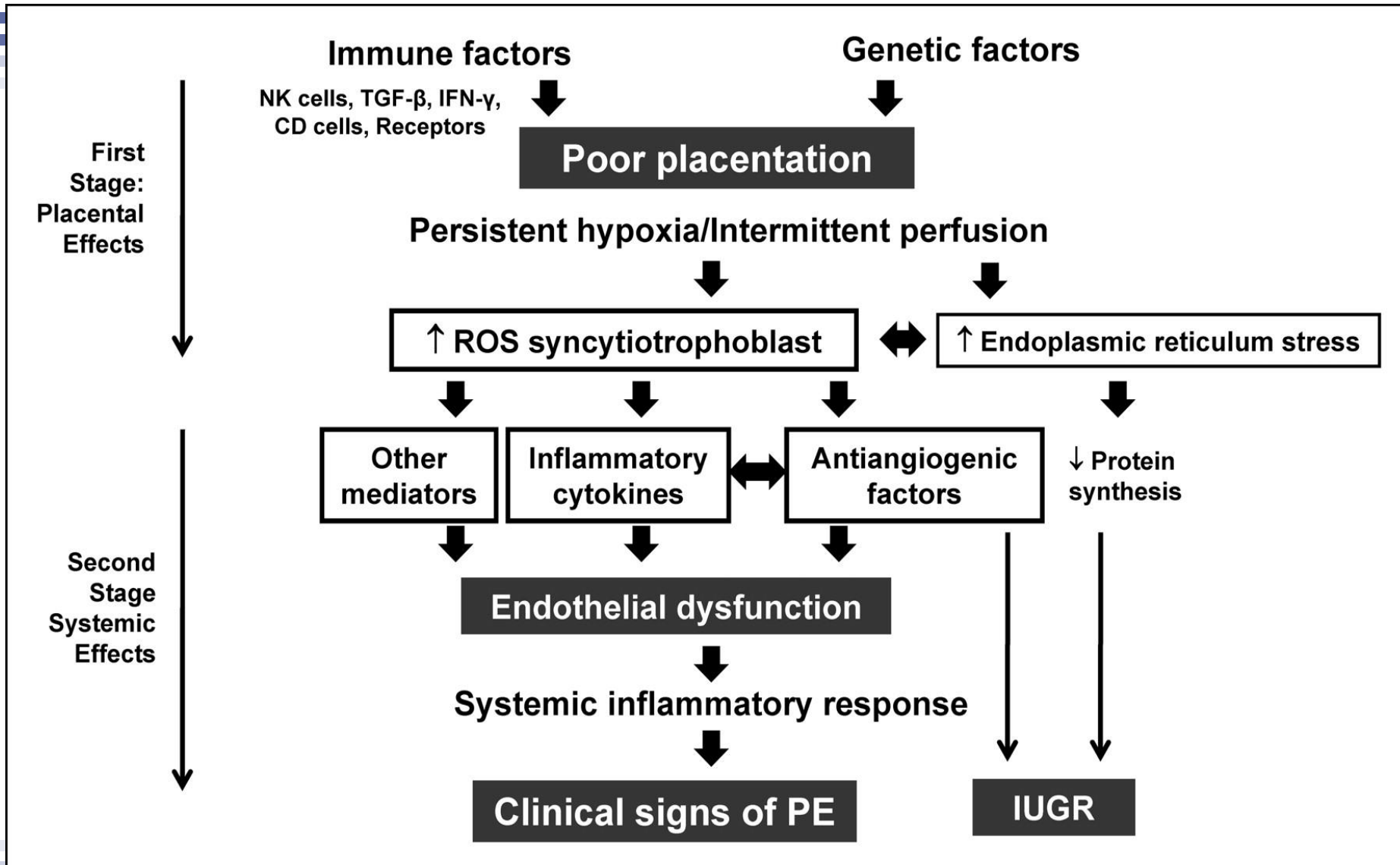
\*The other two had severe longstanding hypertension, one with diabetes, but they died of malignant tumors.

†P calculated from chi square.

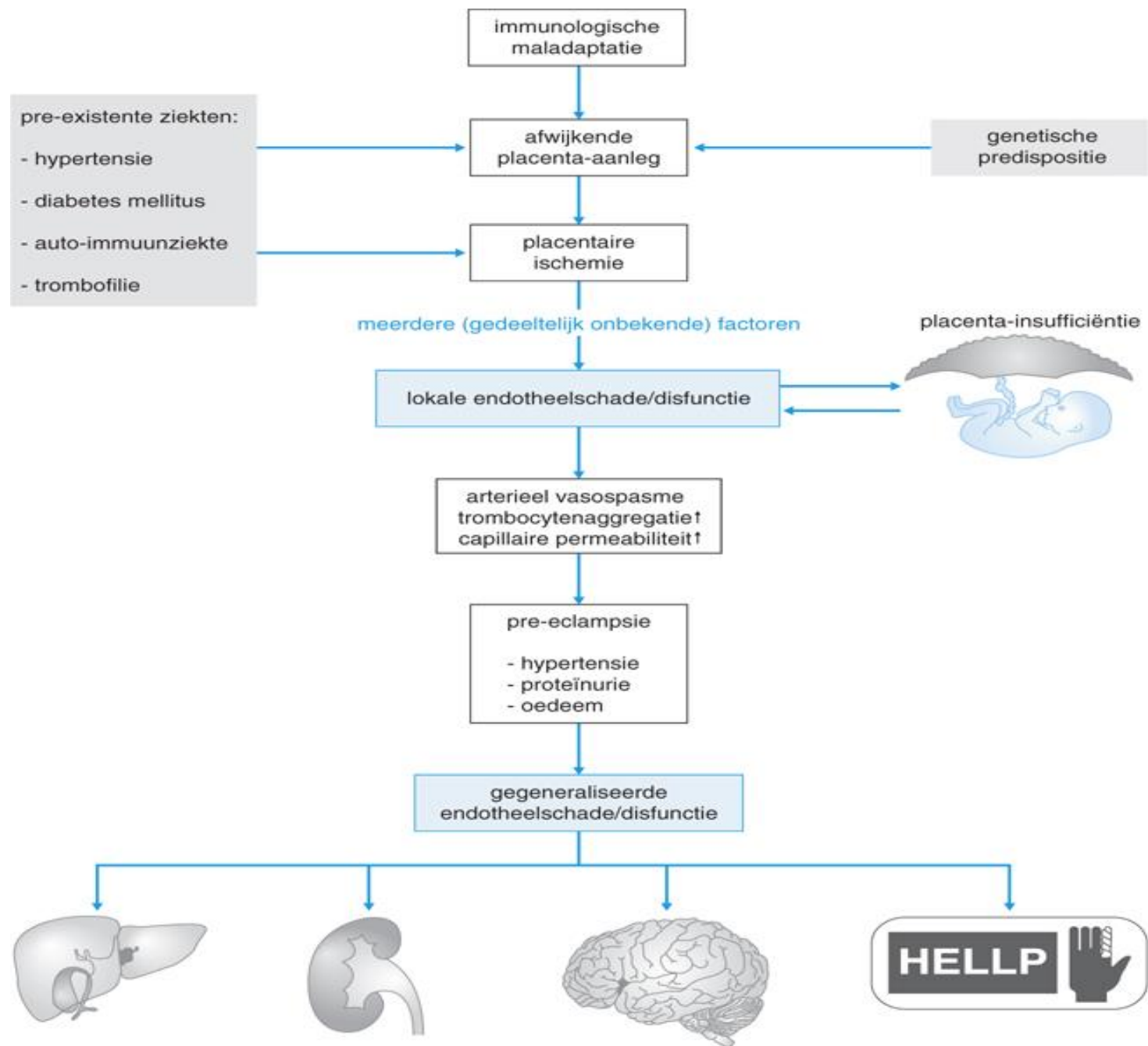
‡P calculated from the Poisson distribution.

Chesley Am J Obstet Gynecol 1976

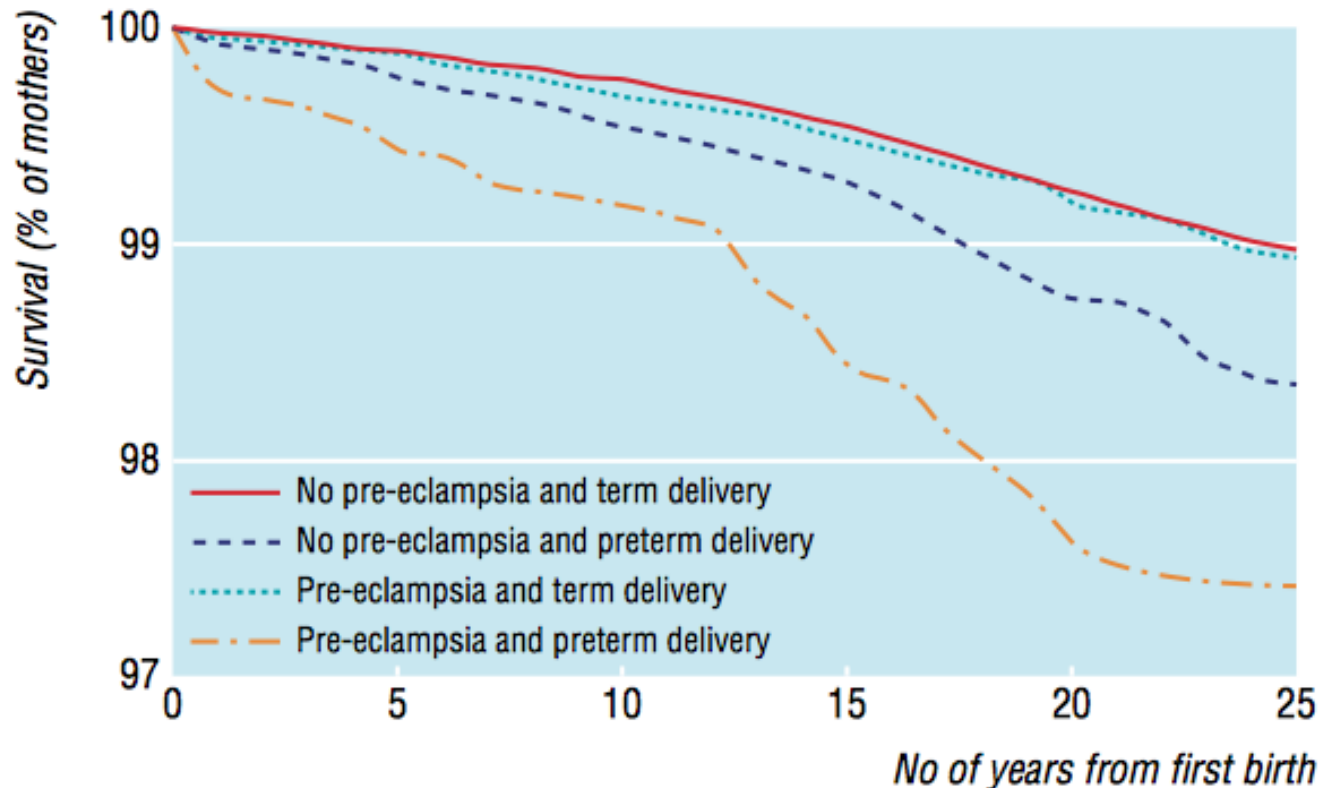
# Wat is preeclampsie?







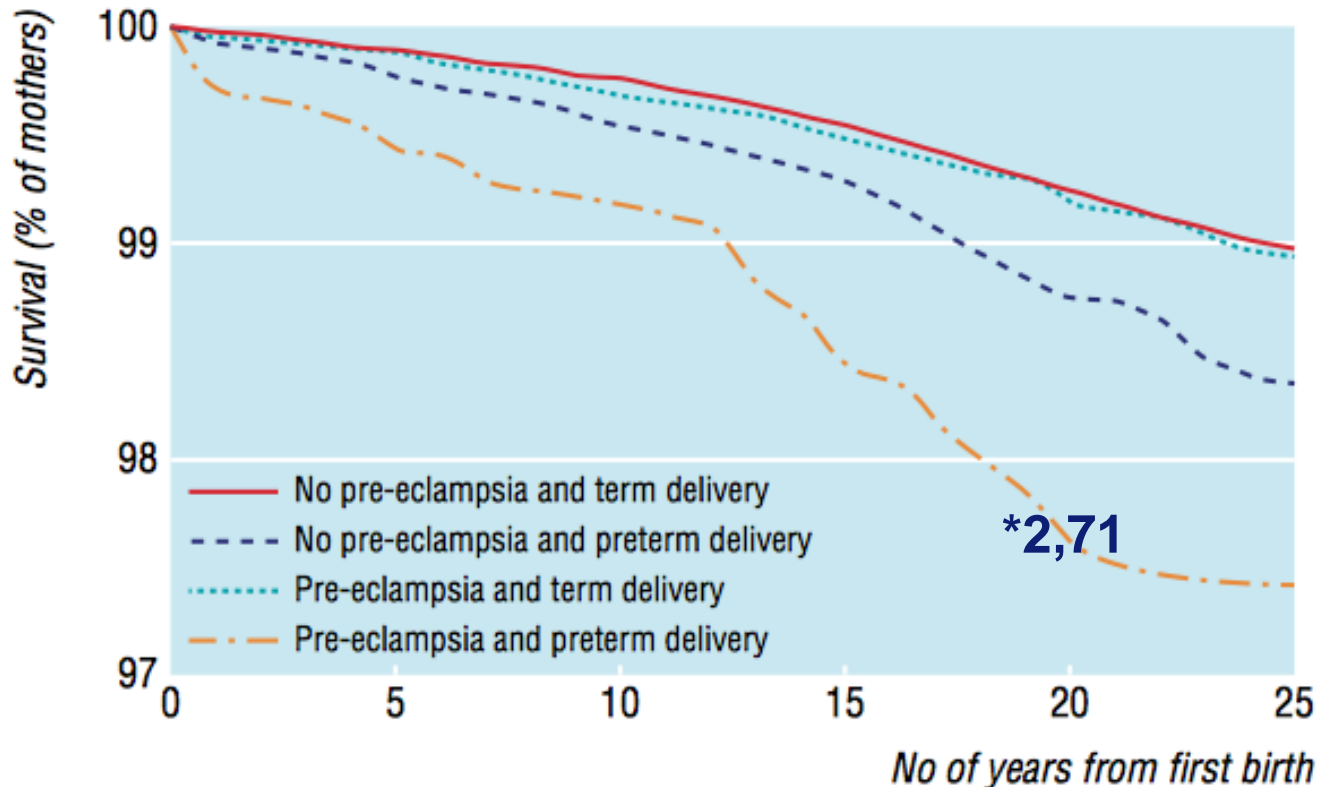
## Hoe ziet de sterfte eruit?



Long term survival of mothers after their first delivery, according to whether they had pre-eclampsia and gestational age of baby at birth (term=37 weeks or more)

Irgens BMJ 2001

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Long term survival of mothers after their first delivery, according to whether they had pre-eclampsia and gestational age of baby at birth (term=37 weeks or more)

Early  
Preeclampsia:  
CVD 8,12\*  
Stroke 5,08  
Cancer 0,36

(\*relative hazard rates)

Irgens BMJ 2001

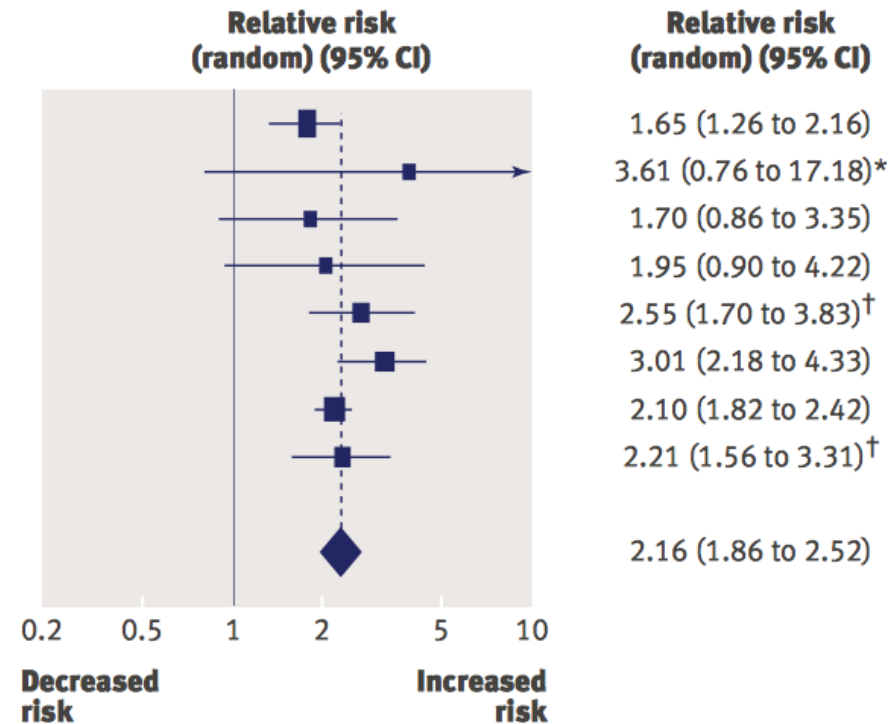
# Wat is de kans op ischaemische hartziekte na preeclampsie?

## Ischaemic heart disease

Study	Total No of cases/ women who had pre-eclampsia	Total No of cases/ women who did not have pre-eclampsia
Hannaforde 1997 <sup>w8</sup>	69/2371	216/14 831
Irgens 2001 <sup>w15</sup>	27/24 155	325/602 117
Smith 2001 <sup>w16</sup>	12/22 781	31/106 509
Wilson 2003 <sup>w13</sup>	26/1043	10/796
Kestenbaum 2003 <sup>w14</sup>	35/20 552	64/92 902
Funai 2005 <sup>w17</sup>	41/1070	269/35 991
Ray 2005 <sup>w18</sup>	228/36 982 <sup>†</sup>	1262/950 885
Wirkstrom 2005 <sup>w19</sup>	176/12 533	2306/383 081
Total (95% CI)	614/121 487	4483/2 187 112

Test for heterogeneity:  $\chi^2=9.60$ ,  $df=7$ ,  $P=0.21$ ,  $I^2=27.1\%$

Test for overall effect:  $z=10.00$ ,  $P=0.001$



# En bij vroege preeclampsie?

## Group of studies

### Parity

Primiparous: 6 studies (4502 cases)

Any pregnancy: 2 studies (595 cases)

### Outcome severity

Fatal ischaemic heart disease: 4 studies (741 cases)

Combined (fatal and non-fatal) ischaemic heart disease:  
4 studies (4356 cases)

### Onset of disease

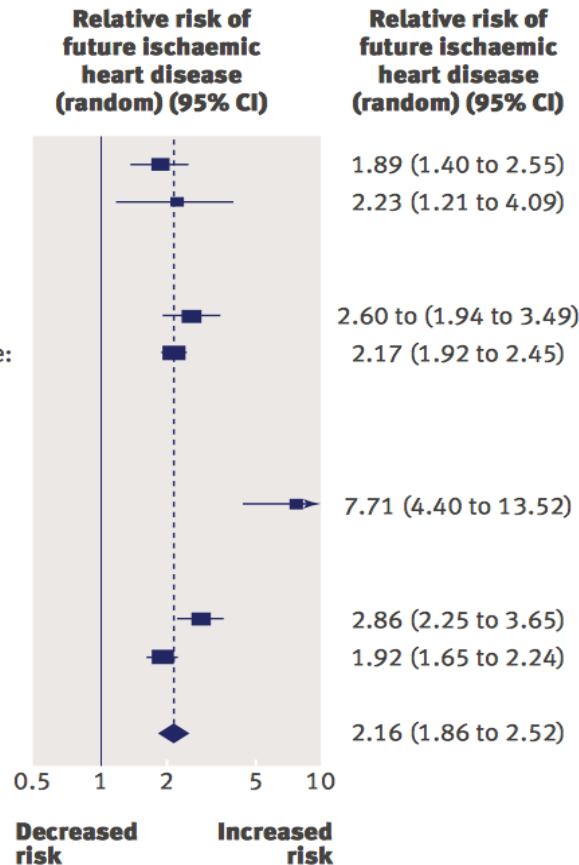
Early pre-eclampsia: 2 studies (50 cases)\*

### Severity of pre-eclampsia

Severe pre-eclampsia: 2 studies (2434 cases)

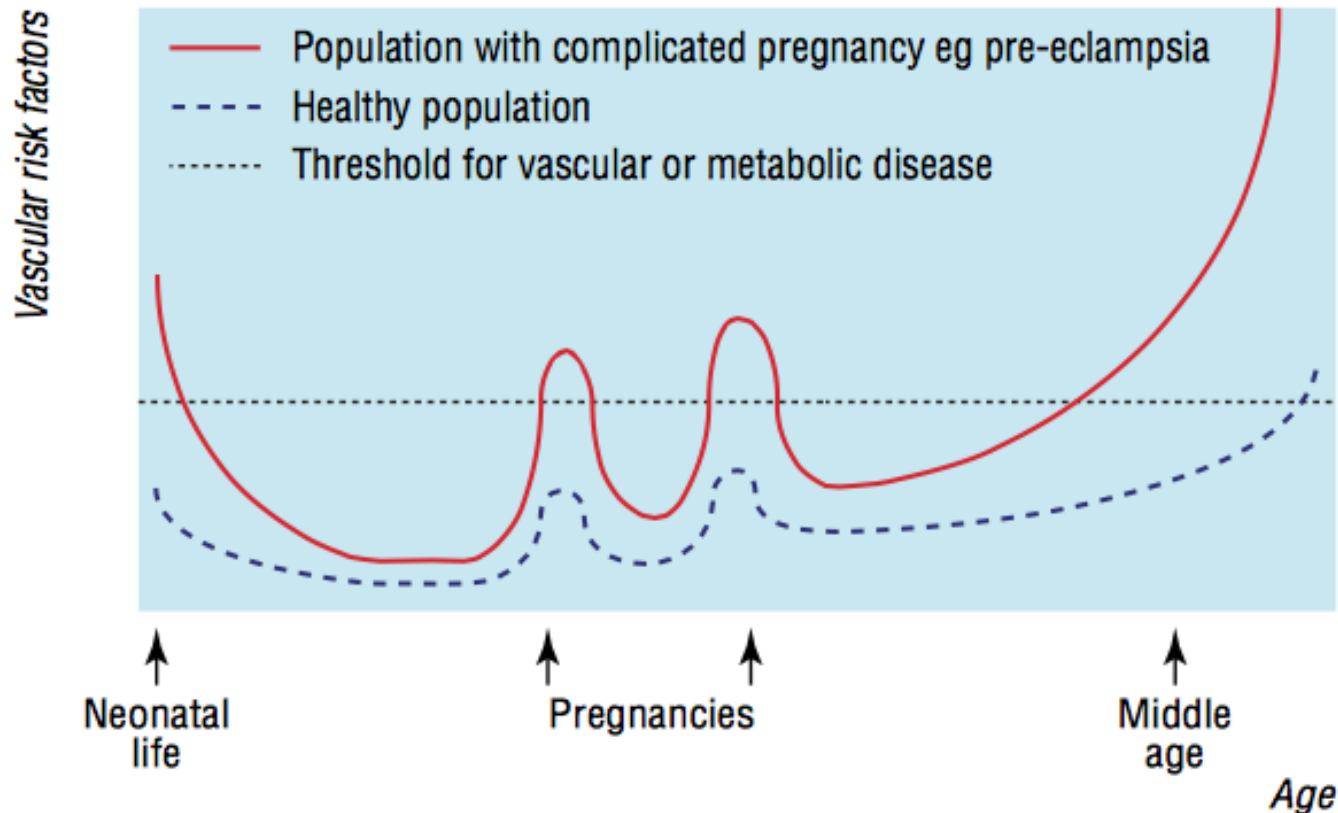
Mild pre-eclampsia: 2 studies (2517)

### Overall relative risk



# Hoe moeten we het voor ons zien?

Sattar Greer BMJ 2002



Risk factors for vascular disease are identifiable during excursions into the metabolic syndrome of pregnancy



DOI: 10.1111/1471-0528.12191  
www.bjog.org

Maternal medicine

## Risk of cardiovascular disease after pre-eclampsia and the effect of lifestyle interventions: a literature-based study

D Berks,<sup>a</sup> M Hoedjes,<sup>b</sup> H Raat,<sup>b</sup> JJ Duvekot,<sup>a</sup> EAP Steegers,<sup>a</sup> JDF Habbema<sup>b</sup>

<sup>a</sup> Division of Obstetrics and Prenatal Medicine, Department of Obstetrics and Gynaecology, <sup>b</sup> Department of Public Health, Erasmus MC, Rotterdam, the Netherlands

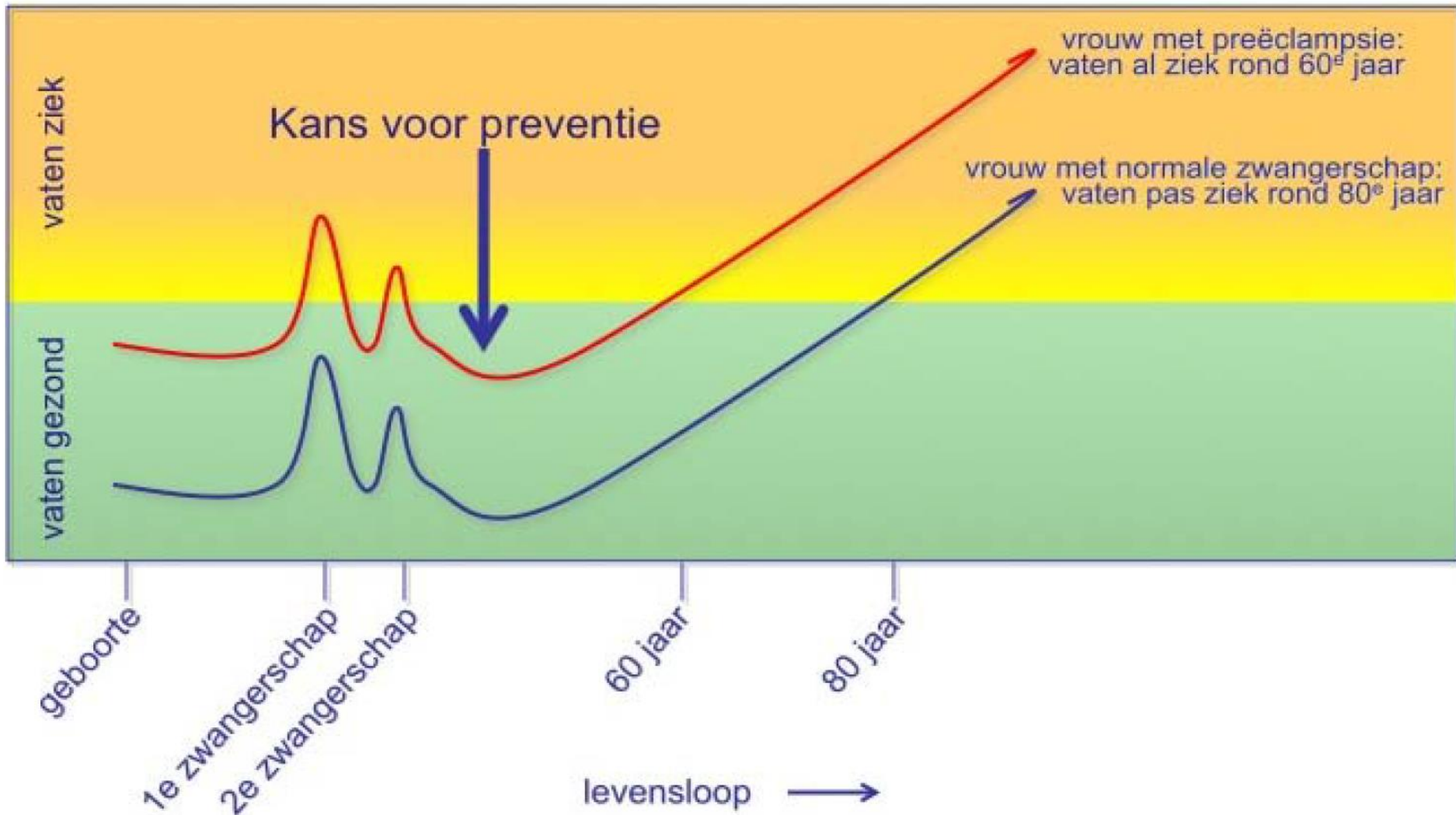
Correspondence: Dr D Berks, Erasmus MC, Department of Obstetrics and Gynaecology, Division of Obstetric and Prenatal Medicine, Doctor Molewaterplein 50, 3015 GE, Rotterdam, the Netherlands. Email d.berks@erasmusmc.nl

Accepted 2 November 2012. Published Online 26 March 2013.

BJOG 2013; 120: 924-931

*Cardiovascular risk factors do not fully explain the risk of cardiovascular disease after preeclampsia. The gap between estimated and observed odds ratios may be explained by an additive risk of cardiovascular disease by preeclampsia. Furthermore, lifestyle interventions after preeclampsia seem to be effective in decreasing cardiovascular risk*

# Zwangerschap als stress test



# Zwangerschapscomplicaties en HVZ risico

- Preeclampsie
- Zwangerschapshypertensie
- Zwangerschapsdiabetes
- IUGR
- Spontane vroeggeboorte
- Placenta loslating
- Excessieve gewichtstoename tijdens de zwangerschap
- Gewichtsretentie postpartum

## Risico factoren voor HVZ

<i>Risk Factor</i>	<i>Risk Ratio (95% C.I) CVD</i>
<b>PCOS</b>	<b>RR 1,38 (1,04-1,83)</b>
<b>POF</b>	<b>RR 1.61 (1.22-2.12)</b>
<b>IUGR</b>	<b>RR 1,66 (1,26-2,18)</b>
<b>Premature delivery</b>	<b>RR 2,06 (1,58-2,18)</b>
<b>Pre-eclampsia</b>	<b>RR 2,15 (1,76-2,61)</b>
<i>Abdominal obesity</i>	<i>RR 2.26 (1.90-2.68)</i>
<i>Smoking</i>	<i>RR 2.86 (2.36-3.48)</i>
<i>Hypertension</i>	<i>RR 2.96 (2.57-3.39)</i>
<i>Diabetes</i>	<i>RR 4.26 (3.51-5.18)</i>
<b>Early pre-eclampsia</b>	<b>RR 7.71 (4.40-13.52)</b>
<b>Familiar hypercholesterolaemia</b>	<b>RR 8.54 (5.29-13.80)</b>

# Hoe veilig is zwangerschap eigenlijk?

Erasmus MC



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# Wat zijn de traditionele risicofactoren?

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# Hoeveel vrouwen moeten we opvolgen?

Erasmus MC



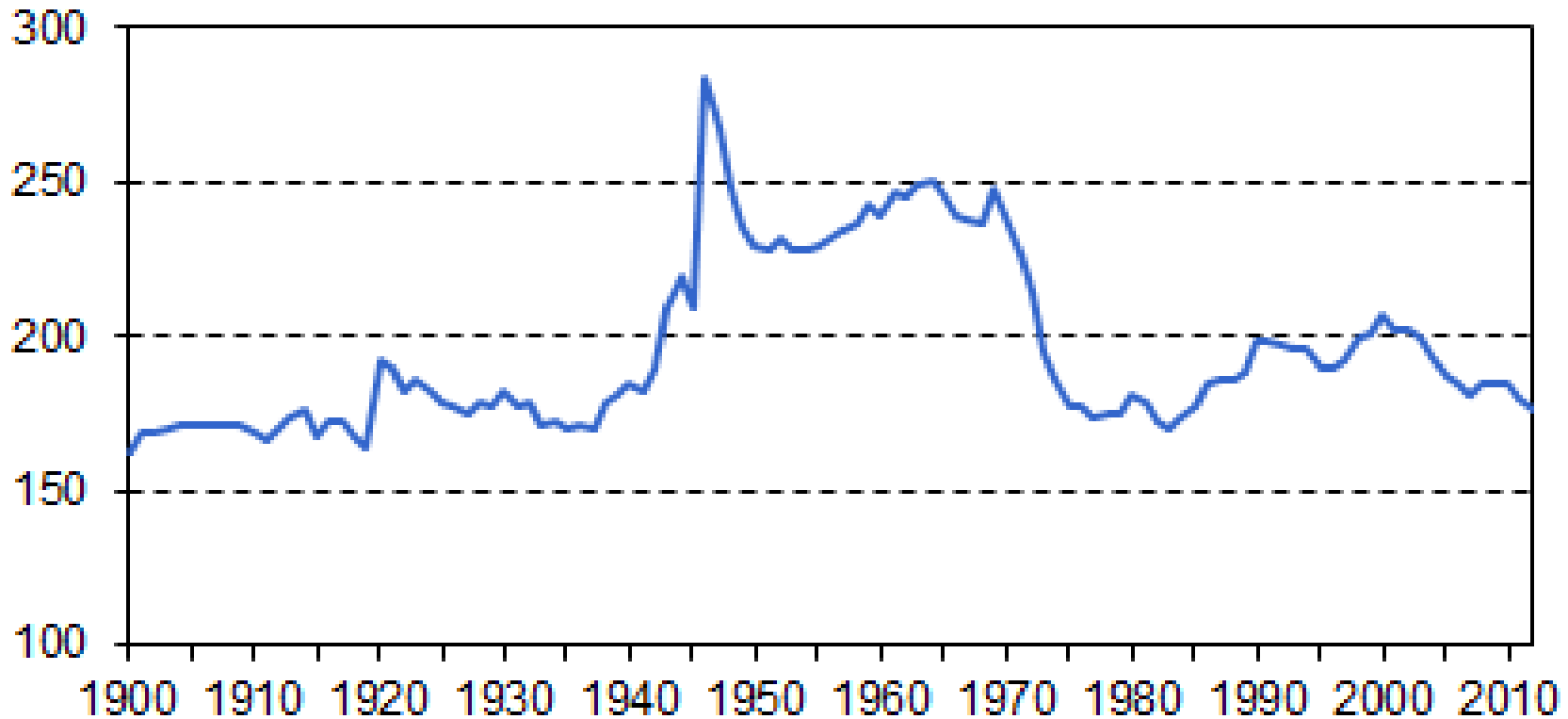
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# Aantal bevallingen in Nederland

aantal levendgeborenen (x 1.000)



## Hoe veilig is zwangerschap? Cijfers 2014

- Jaarlijks worden in Nederland 225.000 vrouwen zwanger
- 25.000 miskramen - 15%
- 26.500 abortus arte provocatus - 15,3%
- 175.000 doorgaande zwangerschappen

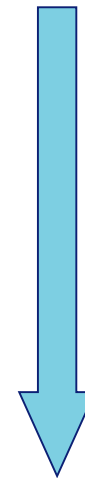
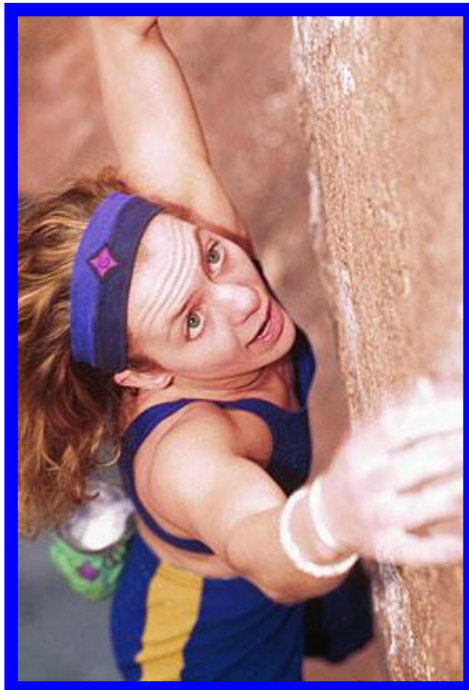
## Hoe veilig is zwangerschap? Cijfers 2014

- Jaarlijks worden in Nederland 225.000 vrouwen zwanger
- 25.000 miskramen - 15%
- 26.500 abortus arte provocatus - 15,3%
- 175.000 doorgaande zwangerschappen
- 21,68% van 175.000 = **37.940 vrouwen**



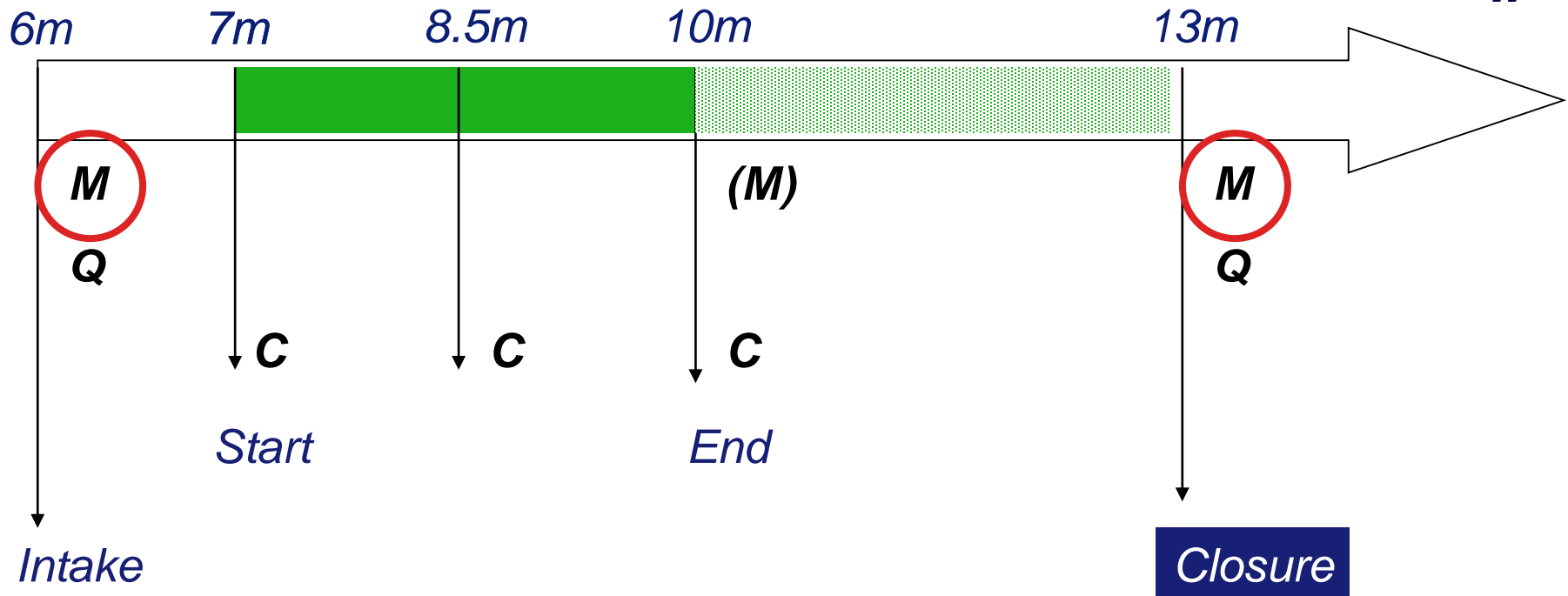
## Wat kunnen we doen? Pro-Active Study

- Young women → Effective!
- Threatening life event → Motivated!
- At risk for cardiovascular disease → Selection!



**Lifestyle Intervention**

# Pro-Active Study – intervention planning



## Measurements

- Weight, height, waist, hip
- Blood pressure, heart rate
- Glucose, insulin, cholesterol

## Questionnaire

- Diet, exercise, smoking habits

Consultation; Motivational interviewing,  
Healthy life check website



## Conclusies



- 200 vrouwen, 140 programma, 60 controles
- Lifestyle intervention na zwangerschap gecompliceerd door preeclampsie/IUGR/zwangerschapsdiabetes:
  - Verbetering HOMA score 59%
  - Minder vet intake - 2,9 gram/dag
  - Lager gewicht/BMI - 1,9 kg/-0,9
  - Lagere waist-to-hip ratio - 4 cm
  - Meer antihypertensiva 19% (totaal 16%)



***Tijdens de zwangerschap moeten bijna alle orgaansystemen harder aan het werk.***

***Zwangerschapscomplicaties ontstaan als niet aan de vraag kan worden voldaan.***

***Veroudering van organen vermindert de reserves waardoor opnieuw symptomen verschijnen.***

# Wat voorspellen zwangerschapscomplicaties nog meer?

- Preeclampsie en kanker
- Preeclampsie en trombo-embolie
- Preeclampsie en nierziekten
- Zwangerschapsdiabetes en diabetes type II
- Sectio en autoimmuun ziektes
- Postpartum depressie en depressieve klachten
- Postpartum thyroiditis en hypothyreoidie

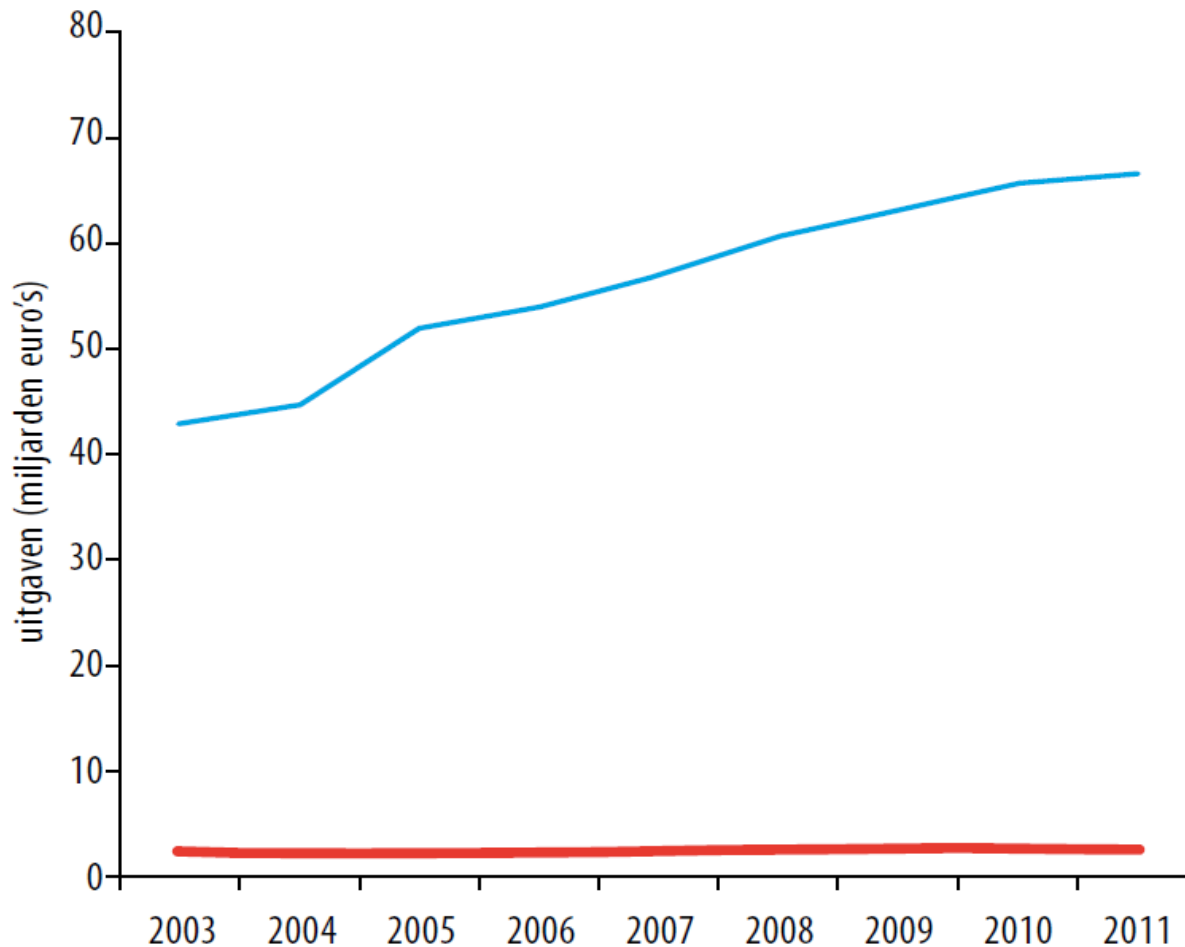
## Wat moet er veranderen?

- **Voorlichting**
- **Meer aandacht bij dokters voor de obstetrische voorgeschiedenis**
- **Aangepast (leefstijl) programma voor vrouwen na een zwangerschapscomplicatie, maar welke?**

## Wat zou in elke anamnese mogen?

- **Obstetrische voorgeschiedenis:**
- **Hoeveel kinderen**
- **Zwangerschapscomplicaties**
- **Gewichtstoename in de zwangerschap**
- **Wijze van bevallen**
- **Verloop van het kraambed**

# Preventie: Follow-Up en PreEclampsie (FUPEC) poli



**FIGUUR 2** Uitgaven aan gezondheidszorg (—) en aan preventie in Nederland (—) in de jaren 2003-2011.<sup>1</sup>

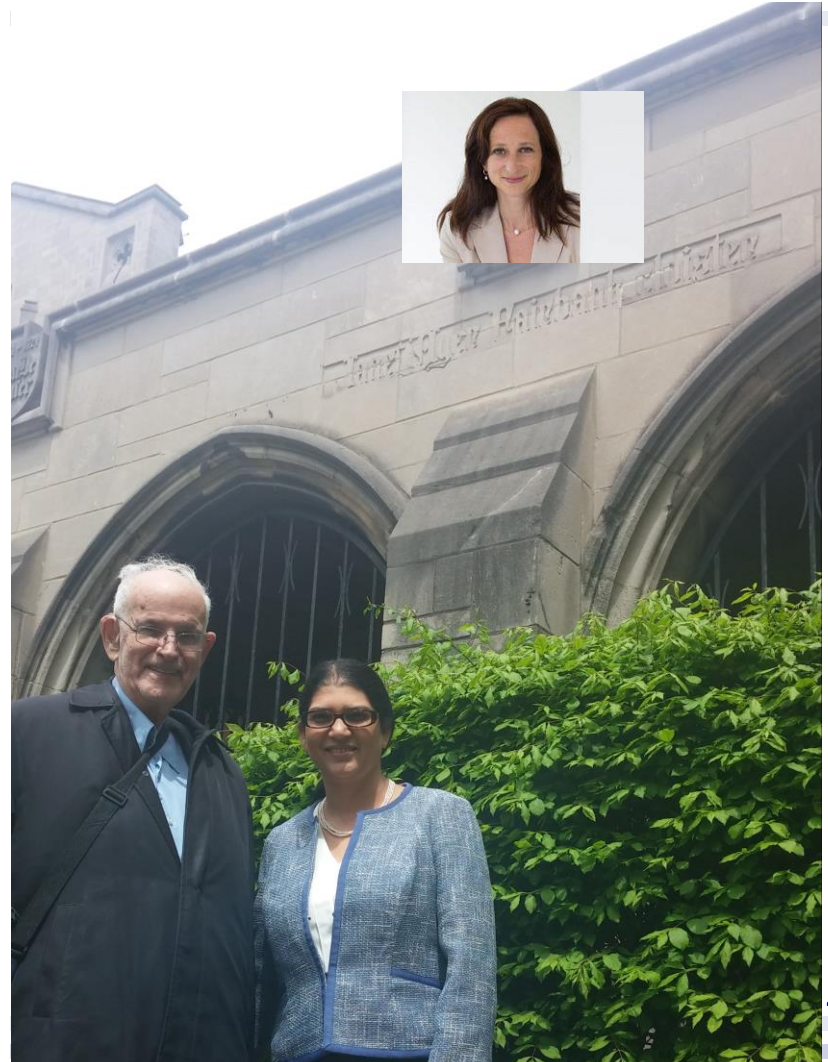


# Chicago Lying in Hospital



# Chicago Lying in Hospital

Erasmus MC



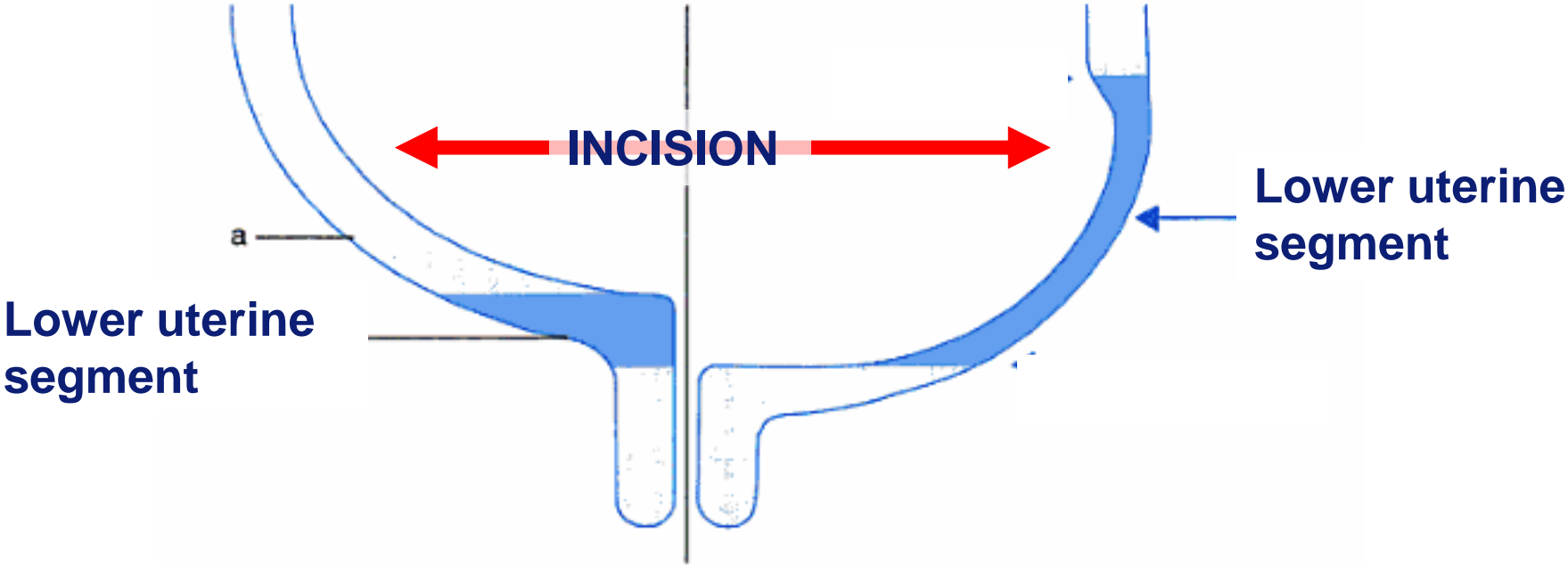




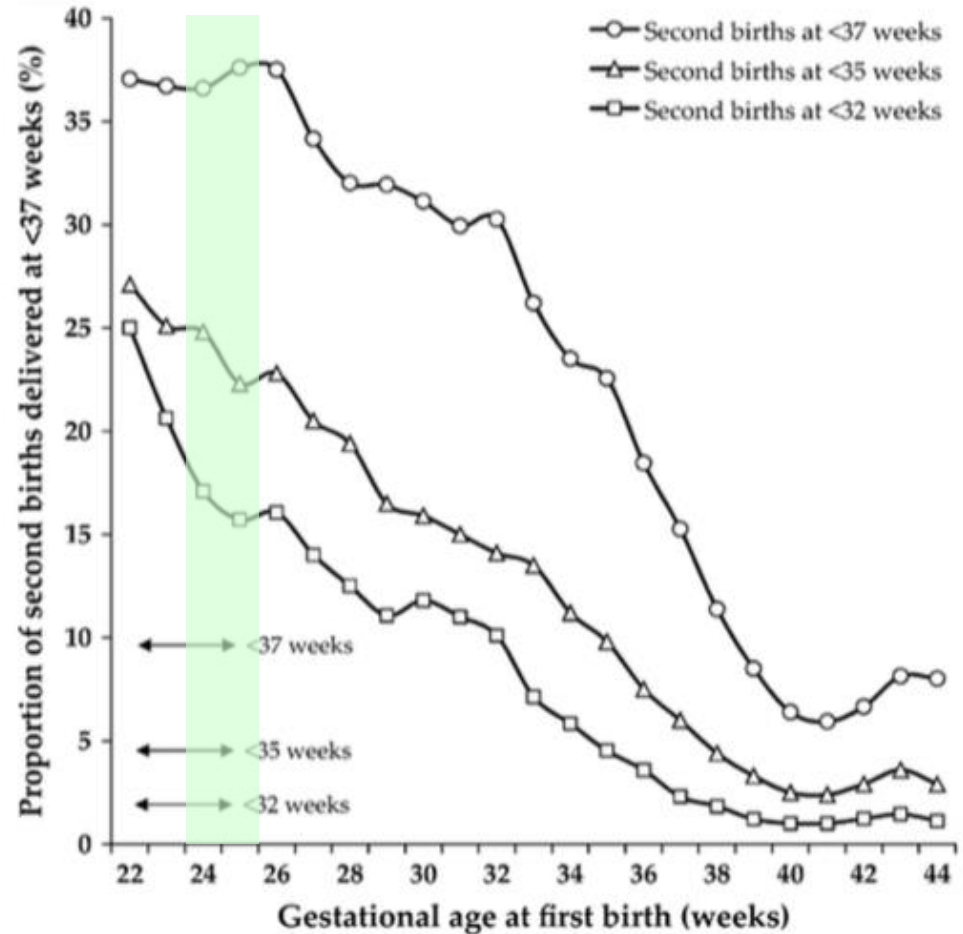
# CS: technique

Preterm

Term



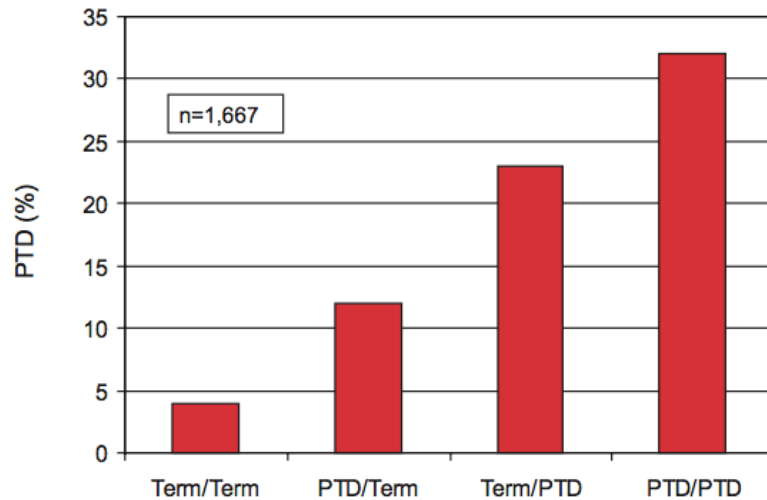
- Neonatal complications
- Obstetric complications
- Recurrence rate?



**Figure 2** Proportion of second births that were delivered at less than 37, less than 35 weeks and less than 32 weeks conditional on gestational age at delivery of the first birth: Missouri, 1989 to 1997. The horizontal lines denote preterm birth rates at less than 37, less than 35, and less than 32 weeks in the first pregnancy.

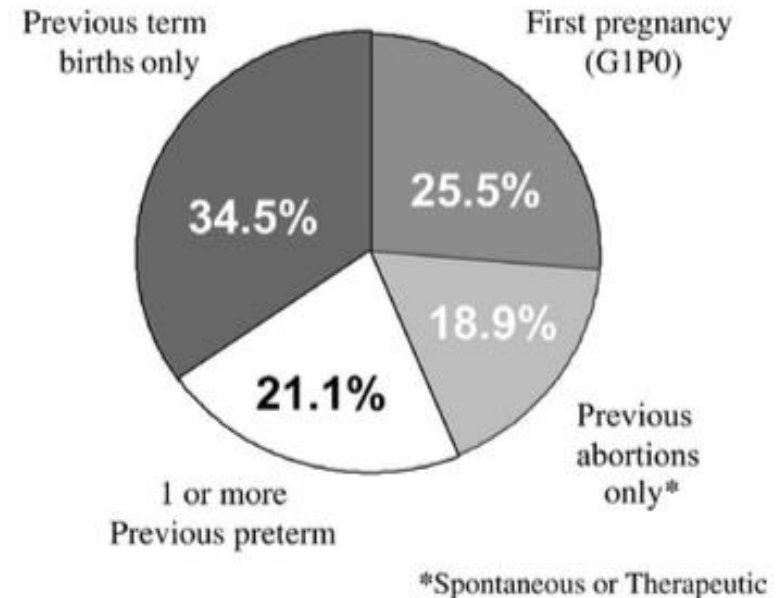


## Recurrence rate?



**Fig. 4.** The risk of subsequent preterm birth is related to the outcome of the prior pregnancy, with the lowest risk occurring when a woman has had two prior term births and the highest risk when she has had two prior preterm births. PTB, preterm delivery. Data from Carr-Hill RA, Hall MH. The repetition of spontaneous preterm labour. *Br J Obstet Gynaecol* 1985;92: 921–8.

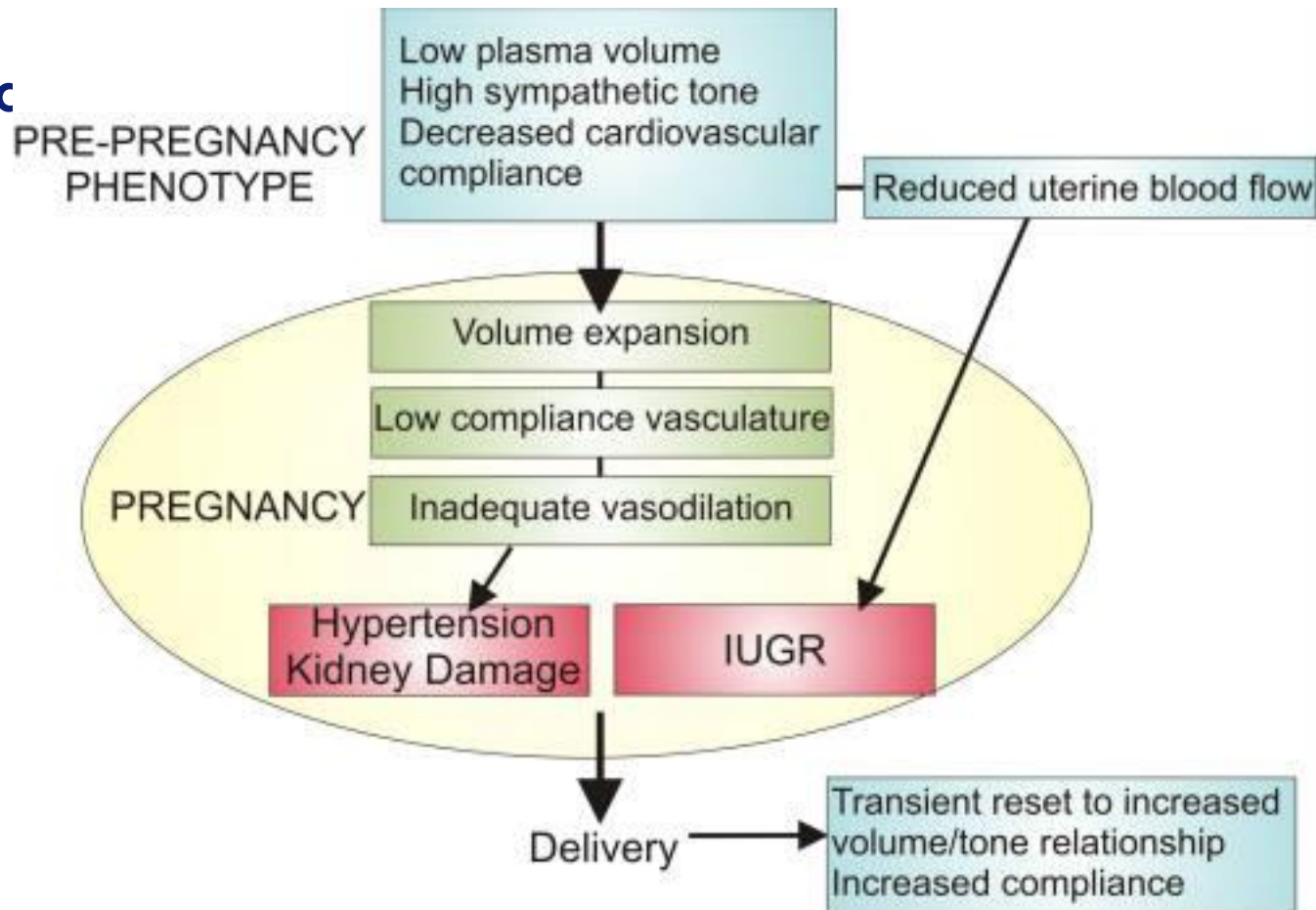
*Spong. Recurrent Spontaneous Preterm Birth. Obstet Gynecol* 2007.



**Figure** Previous obstetric outcome among women who were delivered at 20 weeks to 26 weeks 6 days of gestation in the current pregnancy.



## ■ Pregnc



# Wat is preeclampsie?

