

Gestational Weight Gain



and the outcomes of pregnancy

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SFOG Sweden

Background for this talk



- 2007: Institute of Medicine established a committee to reexamine the American Pregnancy Weight Guidelines.
- The existing 1990 IOM guideline was only based on 'optimal' birthweight.

Important issues:

- Maternal outcomes should also be considered.
- Examine whether there is **a trade-off**:

That optimal gain for the infant may not be the optimal gain for the mother....

- Only little – and only observational - data on these issues.
- Consultant for the committee to provide them with data.

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Aim of this talk



Presentation of the trade-off approach:

- To evaluate the trade-offs in risks between mother and infant for different weight gains.
 - i.e. risks for adverse outcomes.
- To investigate if trade-offs depend on BMI and parity.

STUDY 1:

Nohr EA, Vaeth M, Baker JL, Sorensen TI, Olsen J, Rasmussen KM. Combined associations of prepregnancy body mass index and gestational weight gain with the outcome of pregnancy. *Am J Clin Nutr* 2008; 87:1750-1759.

STUDY 2:

Nohr EA, Vaeth M, Baker JL, Sorensen TI, Olsen J, Rasmussen KM. Pregnancy outcomes related to gestational weight gain in women defined by their body mass index, parity, height and smoking status. In press, AJCN.

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The Danish National Birth Cohort - in short DNBC !!



- No more the world's largest cohort in a pregnant population.
 - 100,000 women and their offspring (1997-2002)
- Ethnicity ?
 - Caucasian women !
 - Only 3.5% of the cohort is not of Scandinavian origin.
- Prevalence of obesity ?
 - 11% of Danish childbearing women are obese.
 - In the cohort: 8% obese.

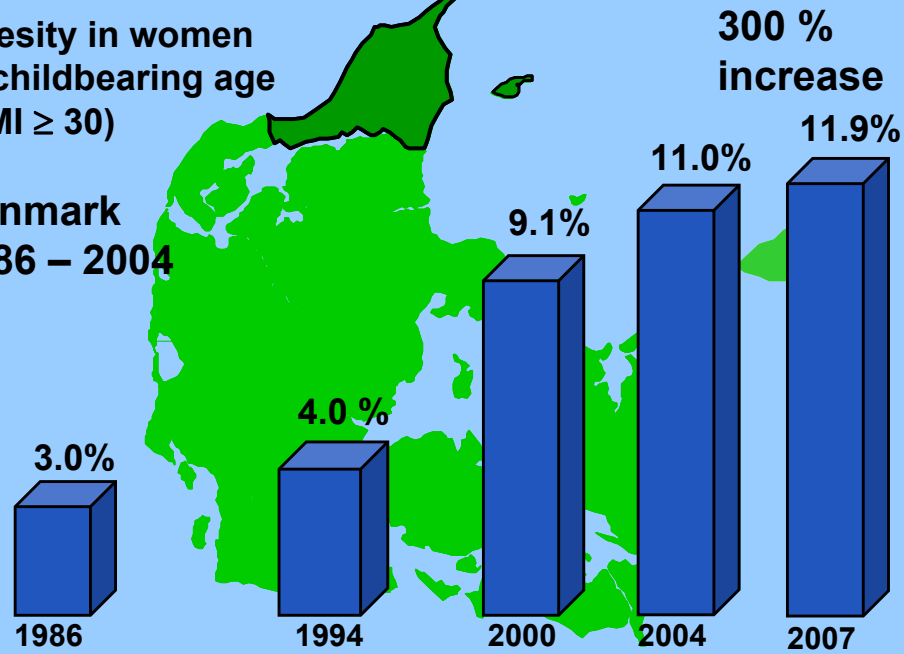
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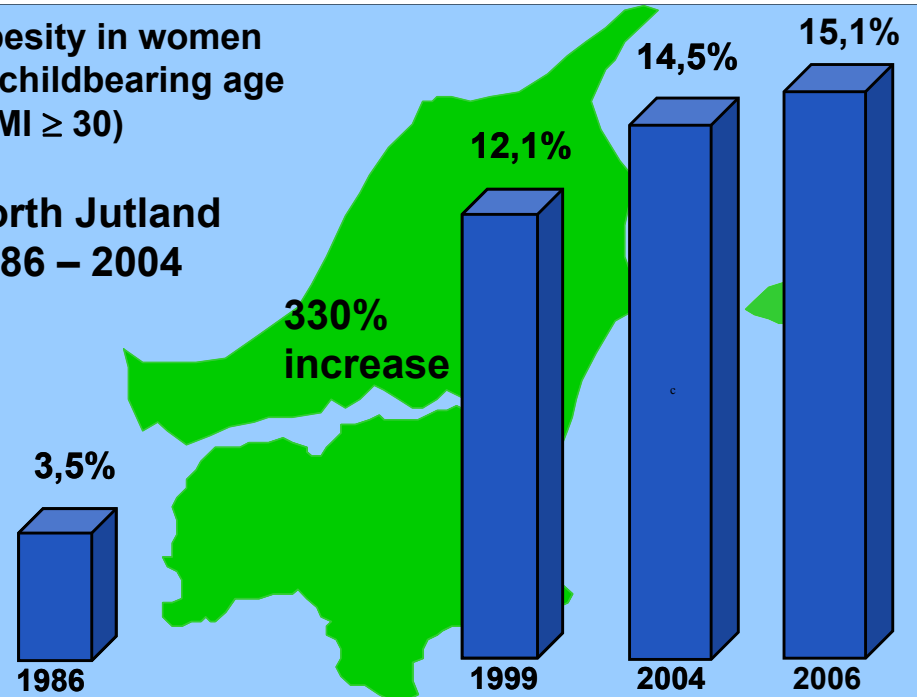
Obesity in women of childbearing age (BMI ≥ 30)

Denmark 1986 – 2004



Obesity in women of childbearing age (BMI ≥ 30)

North Jutland 1986 – 2004



Development in GWG in North Jutland.

- Huge increase in overweight and obesity: 13% → 38%.
- Increase in mean GWG of 1.6 kg .

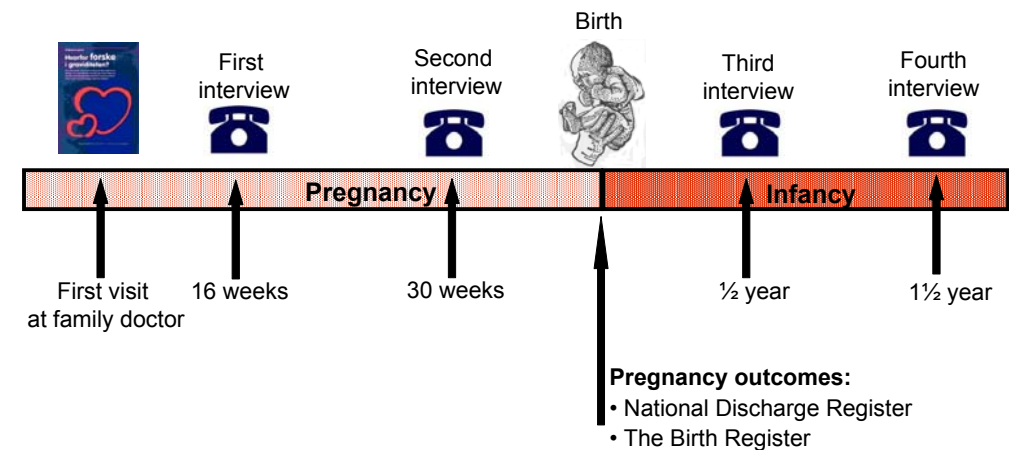


	County data 1984-87* N=7760		County data 1996-2002* N=8685	
		Mean GWG		Mean GWG
Prepregnancy BMI				
Underweight (<18.5)	9.4 %	13,3 kg	3.9%	16,3 kg
Normal weight (18.5-25)	77.8 %	13,6 kg	58.5%	16,1 kg
Overweight (25-30)	9,8 %	13,0 kg	23.2%	14,7 kg
Obese (30+)	3,0 %	9,8 kg	14.5%	10,9 kg
Total		13.4 kg		15.0 kg

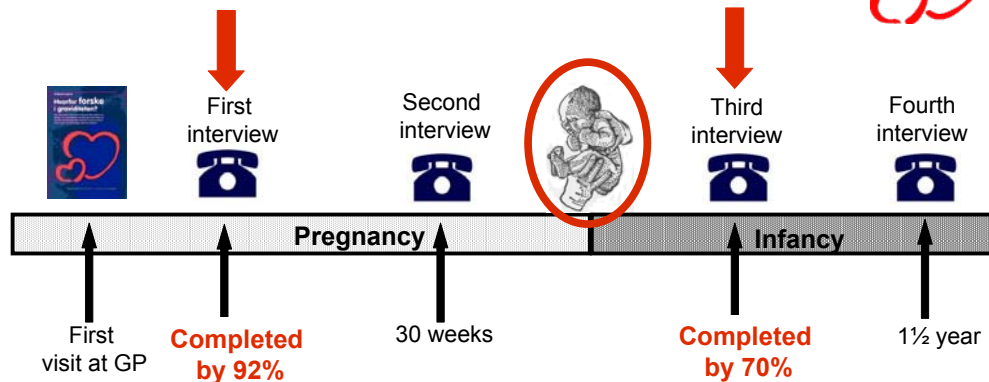
Hytten suggested 12.5 kg – not far from Danish reality back in 1985!!

* Data described in the following papers: J. Olsen et al. 'Changing smoking, drinking, and eating behaviour among pregnant women in Denmark' *Scand.J.Soc.Med* 1989; 17:277-280 and Nohr EA et al. 'Does Low Participation in Cohort Studies Induce Bias?' *Epidemiology* 2006; 17(4):413-418.

Data collection in the DNBC



Data for study of GWG



Inclusion criteria:

- Pregnancies ending with term liveborn singletons.
- Participation in first and third interview.
- Information about 'weight variables'.

➔ **Study population: 60,892 pregnancies**

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Material & methods



- Main exposures were self-reported BMI and gestational weight gain:

➤ Categorized prepregnancy BMI (WHO):

• Underweight:	<18.5
• Normal weight:	18.5 – 25
• Overweight:	25 – 30
• Obese:	30+

➤ Gestational weight gain (GWG) in 4 categories:

• Low gain	< 10 kg	~ 13 %
• Medium gain	10 - 15 kg	~ 45 %
• High gain	16 - 19 kg	~ 21 %
• Very high gain	≥ 20 kg	~ 21 %

- 40% of underweight, normal weight and overweight women had gains > 15 kg.
- Only 20% of obese women had gains > 15 kg.

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Presentation of the trade-off approach



An additive approach:

- Evaluate risk differences instead of odds ratios.
- **WHY?** Background risks of most pregnancy outcomes increased with BMI↑:
 - Not well reflected in a multiplicative model.
- **INSTEAD:** Comparison of absolute risk differences across BMI groups.
- **4 OUTCOMES:**
 - Small-for-gestational-age (SGA): Z-score<10th percentile
 - Large-for-gestational-age (LGA): Z-score>90th percentile
 - Emergency cesarean delivery: Cesarean section during labor
 - Postpartum weight retention (PPWR): Gain ≥ 5kg 6 months post partum

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Statistical methods



• Logistic regression

Odds ratios for the BMI and GWG-specific association with each outcome.

➤ Other covariates in the models:

- Age, height, parity.
- Smoking, alcohol consumption, physical exercise & social status.
- Gestational age at birth.
- Breastfeeding duration (for post partum weight retention).

- **16 absolute risks (4 BMI x 4 GWG groups) were derived from these odds ratios.**

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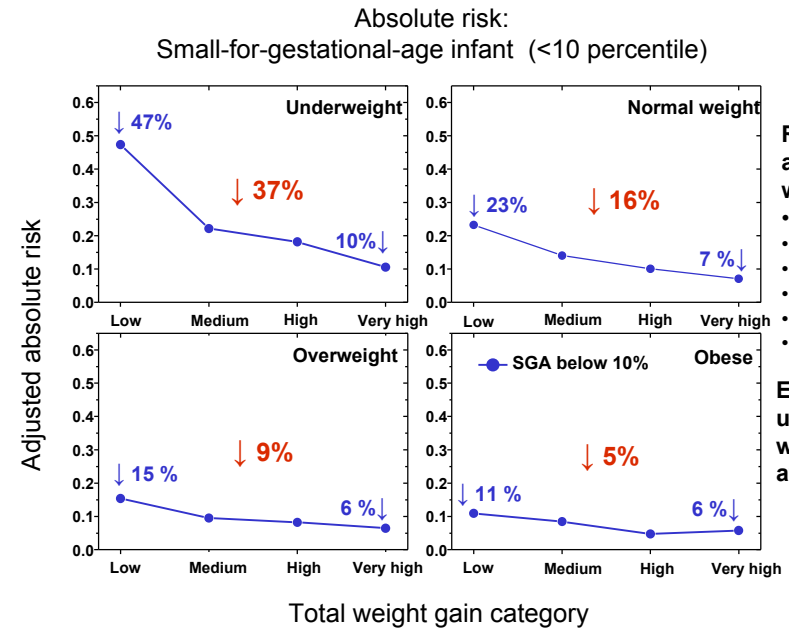
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RESULTS STUDY 1



Comparison of absolute risk differences across BMI groups

STUDY 1:
Nohr EA, Vaeth M, Baker JL, Sorensen TI, Olsen J, Rasmussen KM. Combined associations of prepregnancy body mass index and gestational weight gain with the outcome of pregnancy. *Am J Clin Nutr* 2008; 87:1750-1759.



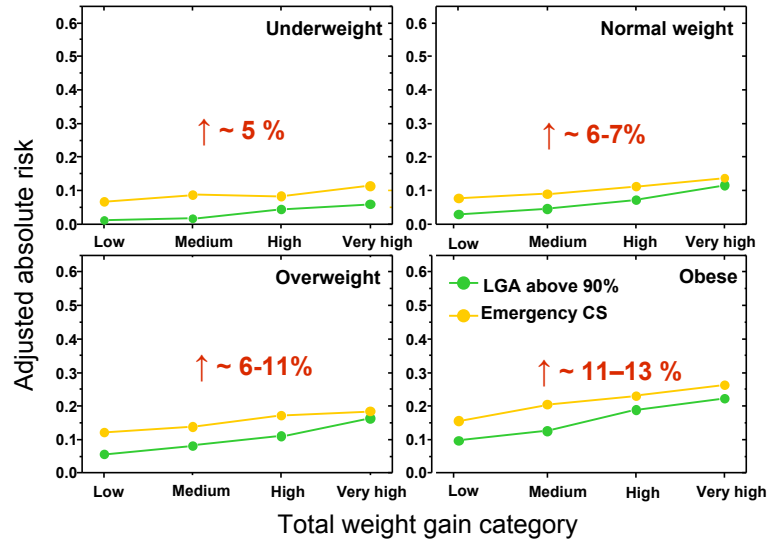
Risks of a primiparous woman:

- 25-29 years,
- Normal height,
- No smoking,
- No alcohol,
- No exercise,
- High social status.

Especially underweight women should avoid lower gains !

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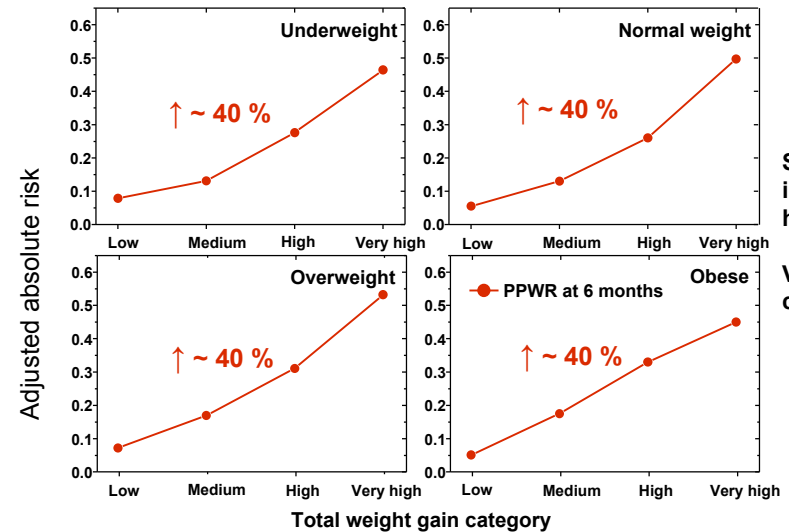
Absolute risks:
Large-for-gestational-age infant and emergency caesarean delivery



Risk differences increased with increasing BMI !

Points present risks of a primiparous woman, aged 25-29, height 160-69, non-smoker, no alcohol consumption, high social status, no exercise and 280 days of gestation.

Absolute risks:
Post partum weight retention ≥ 5kg 6 months post partum



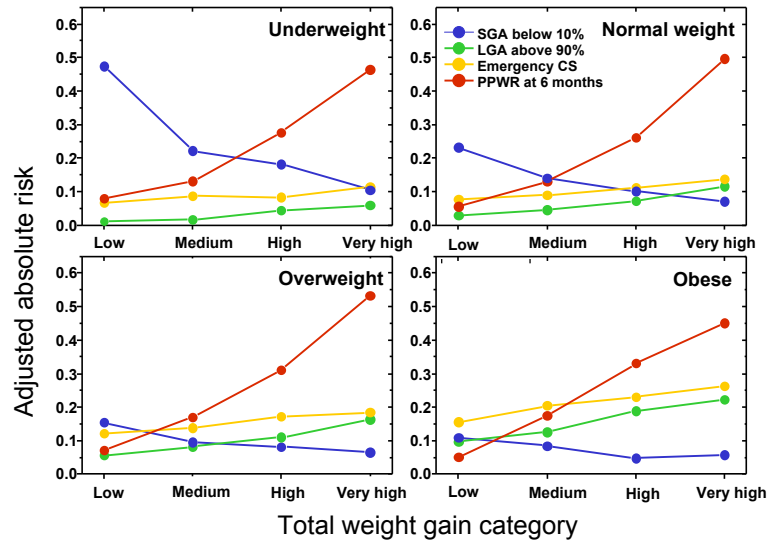
Same risk increase with higher gains.

Very different clinical relevance...

Points present risks of a primiparous woman, aged 25-29, height 160-69, non-smoker, no alcohol consumption, high social status, no exercise and 280 days of gestation.



Absolute risks:
Trade-off between 4 important pregnancy outcomes



When do disadvantages of high gains outweigh their advantages ?

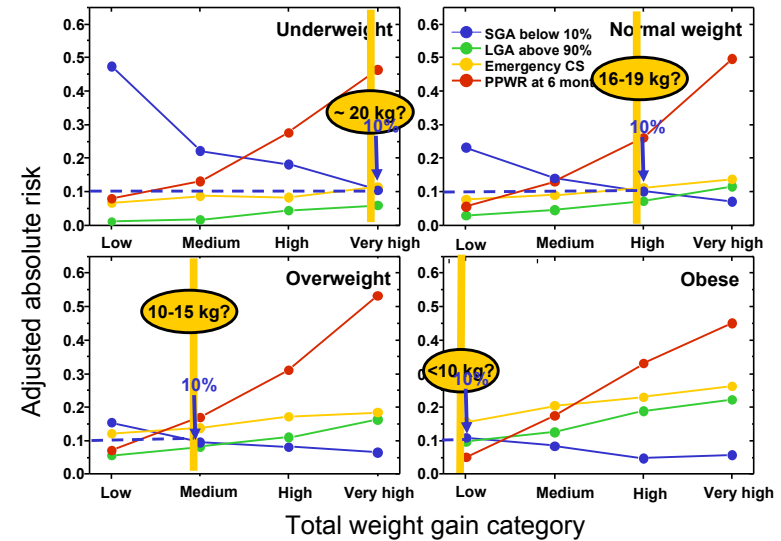
Points present risks of a primiparous woman, aged 25-29, height 160-69, non-smoker, no alcohol consumption, high social status, no exercise and 280 days of gestation.

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Absolute risks:
Trade-off between 4 important pregnancy outcomes



When do disadvantages of high gains outweigh their advantages ?

Not a trivial exercise !

Please go ahead yourself !

Points present risks of a primiparous woman, aged 25-29, height 160-69, non-smoker, no alcohol consumption, high social status, no exercise and 280 days of gestation.

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Main conclusions, Study 1



- Underweight women should avoid low gain and rather feel free to gain weight, also to the upper limit.
 - May prevent having a small baby.
 - Does not appear to have deleterious consequences.
 - Normalizes their body weight.
- Heavier women may benefit from avoiding high and very high gain (gains >15 kg)!
- Especially, obese women may benefit from low gain (<10 kg)!
 - Only associated with a slight increase in growth restriction for the infant.
 - May decrease risks of maternal complications.
 - May help them normalize their weight.

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RESULTS STUDY 2



Does the trade-off between mother and child depend on parity?

STUDY 2:

Nohr EA, Vaeth M, Baker JL, Sørensen TI, Olsen J, Rasmussen KM. Pregnancy outcomes related to gestational weight gain in women defined by their body mass index, parity, height and smoking status. Under revision, AJCN.

STUDY 2

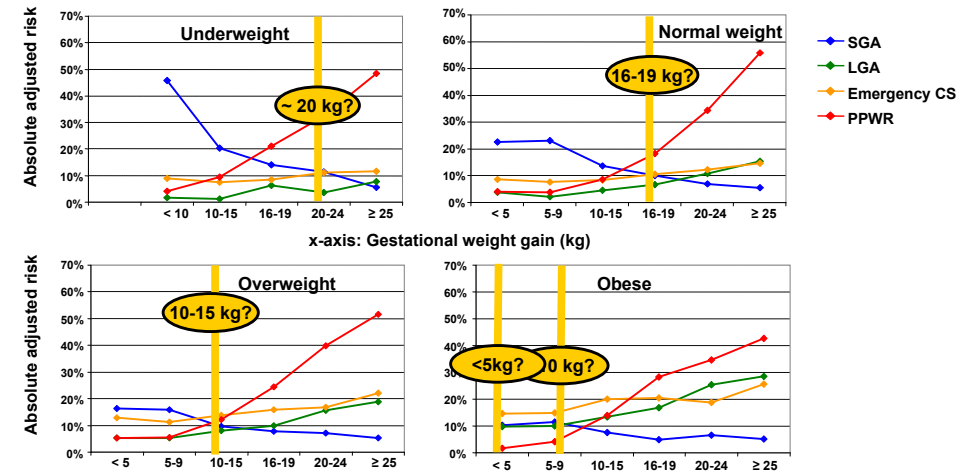
The trade-off analysis within primiparae and multiparae.



METHODS

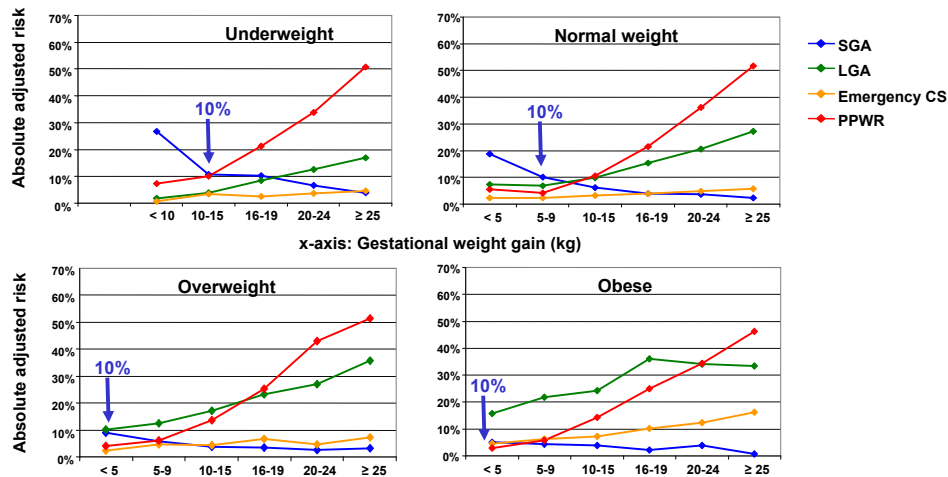
- Studypopulation from previous study divided into
 - Primiparous women (app 27.000).
 - Multiparous women (app. 32.000).
- Multiple logistic regression within each of these populations.
 - Odds ratios for SGA, LGA, emergency cesarean section, PPWR.
 - Absolute adjusted risks were derived from odds ratios.
- GWG: 4 groups extended to 6:
 - 1 very low: < 5 kg and 1 extremely high: ≥ 25 kg.
 - In underweight women, <5 kg and 5-9 kg were pooled to < 10 kg.

Primiparae: Age 25-29, height 160-169, no smoking or alcohol, moderate exercise, high social status.



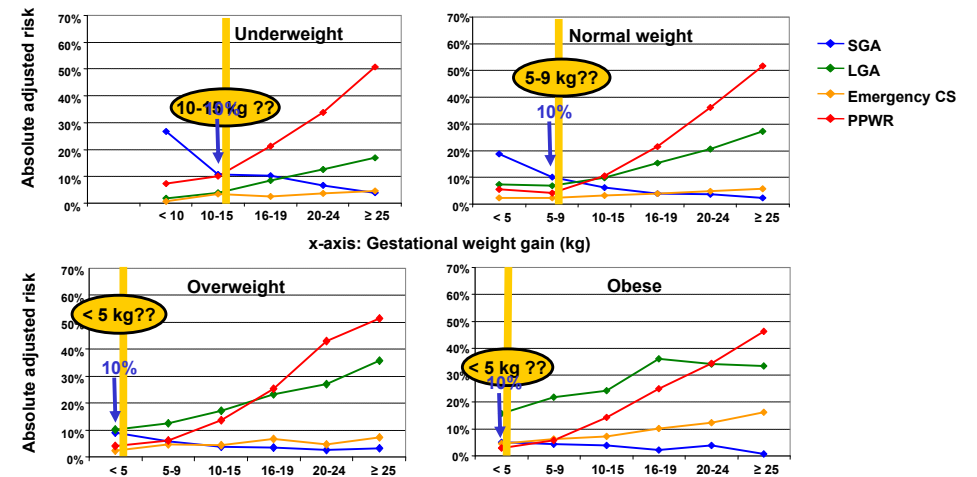
As previous trade-off-figure, only more GWG-categories.
May justify lower threshold for obese women ?

Multiparae: Age 25-29, height 160-169, no smoking or alcohol, moderate exercise, high social status.



1. The risk of SGA had decreased to 10% at lower GWG levels
- actually at 2 gain categories lower than seen in primiparae.

Multiparae: Age 25-29, height 160-169, no smoking or alcohol, moderate exercise, high social status.



May be a justification for recommending lower GWG for multiparae ???
Findings need to be replicated in other data sources and populations...

Conclusions, study 2



- Primiparae may need higher GWG to eliminate excess risk of SGA.
 - WHY?
 - Especially in primiparae, fetal growth is restricted by available space.
 - The relative importance of available space and energy supply may differ in primiparous and multiparous women.
- Irrespective of parity: Steeply increasing risk of postpartum weight retention with increasing gain.
- A considerable excess risk of LGA was only present in obese primiparae and multiparous women.
- Findings suggest that
 - Multiparae may reach an overall favorable pregnancy outcome at a lower GWG.
 - Perhaps GWG recommendations could be lower in multiparous women.
- may provide an attractive approach to reduce postpartum weight retention.

Limitations:



- **We only evaluated a restricted number of outcomes.**
 - The conclusions may be different if other outcomes were examined.
- **Caution with observational data:**
 - These data does not come from a randomized trial!
 - For most outcomes: causal relations – if present - are only partly understood.