Consequences of Gestational Weight Gain:

Outcomes for the mother and child

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June 5, 2008

IOM workshop on GWG Guidelines

Aim of this talk!

- Presentation of our study :

"Combined associations of prepregnancy BMI and gestational weight gain on the outcome of pregnancy"

by Nohr EA, Vaeth M, Baker J, Sorensen T, Olsen J, Rasmussen KM.
Will be published in this months issue of
***American Journal of Clinical Nutrition*.**

Aim of the study:

- To investigate the combined associations of prepregnancy BMI and gestational weight gain with pregnancy outcomes.

- To evaluate the trade-offs between mother and infant for different weight gains.

The Danish National Birth Cohort - in short DNBC !!

- Still 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 ?
  Behind the US, but on the rise !

Antenatal care in Denmark during the study period

Stable, universal and tax paid health care system where more than 99% of women access public prenatal care.

GWG recommendations

- The official Danish Guideline stressed not to be concerned about weight gain.
  - Lack of evidence.
  - 'No reason for control of weight at every visit!'

Midwives' reaction:

- Most continued weighing and documenting weight at every visit.
- However, not much weight gain advice was given.

Data collection in the DNBC

Danish National Birth Cohort

First interview

Second interview

Birth

Third interview

Fourth interview

Pregnancy | **Infancy**

First visit at family doctor

16 weeks

30 weeks

½ year

1½ year

Pregnancy outcomes:
- National Discharge Register
- The Birth Register

- Blood samples: Women/newborns

Data for study of GWG

Danish National Birth Cohort

First interview

Second interview

Third interview

Fourth interview

Pregnancy

Infancy

First visit at GP

Completed by 92%

30 weeks

Completed by 70%

1½ year

Inclusion criteria:

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

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

Material & methods

Danish National Birth Cohort

- Self-reported anthropometric variables:

- Main exposures:

  Categorised prepregnancy BMI (WHO):

  - **Underweight: <18.5**
  - **Normal weight: 18.5 – 25 (ref. group)**
  - **Overweight: 25 – 30**
  - **Obese: 30+**

  Gestational weight gain in 4 categories:

  - **Low gain < 10 kg ~ 13 %**
  - **Medium gain 10 -15 kg ~ 45 % (ref. group)**
  - **High gain 16 -19 kg ~ 21%**
  - **Very high gain ≥ 20 kg ~ 21%**

- A wide range of pregnancy and neonatal outcomes.

Analytical approach

Danish National Birth Cohort

1) Logistic regression:

To examine the impact of BMI and GWG when mutually adjusted.
To evaluate interaction between BMI and GWG.

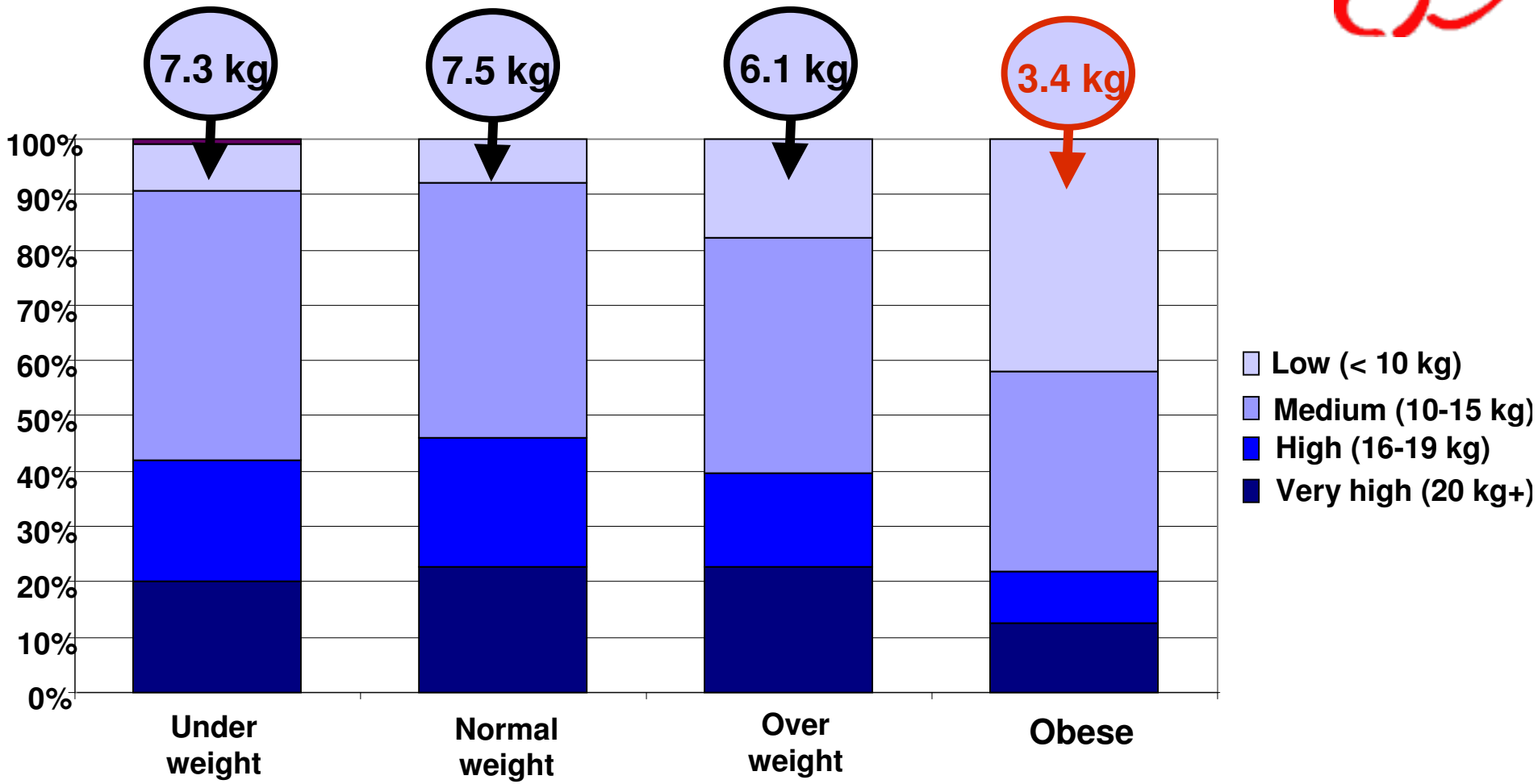
Other covariates in the models:

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

2) Comparisons of BMI- and GWG-specific absolute risks.

3) BMI-migration according to prepregnancy BMI and GWG.

Gestational weight gain according to prepregnancy BMI



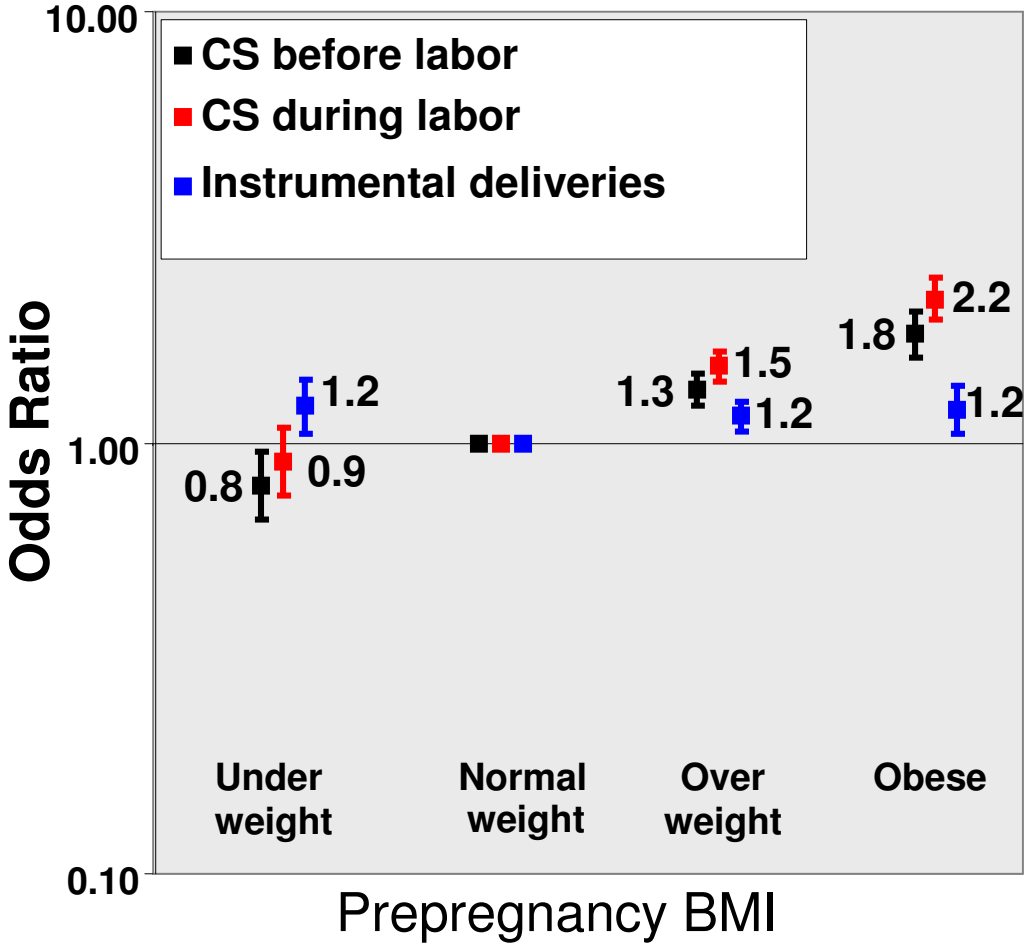
Only ~ 20% of obese women have higher gains.

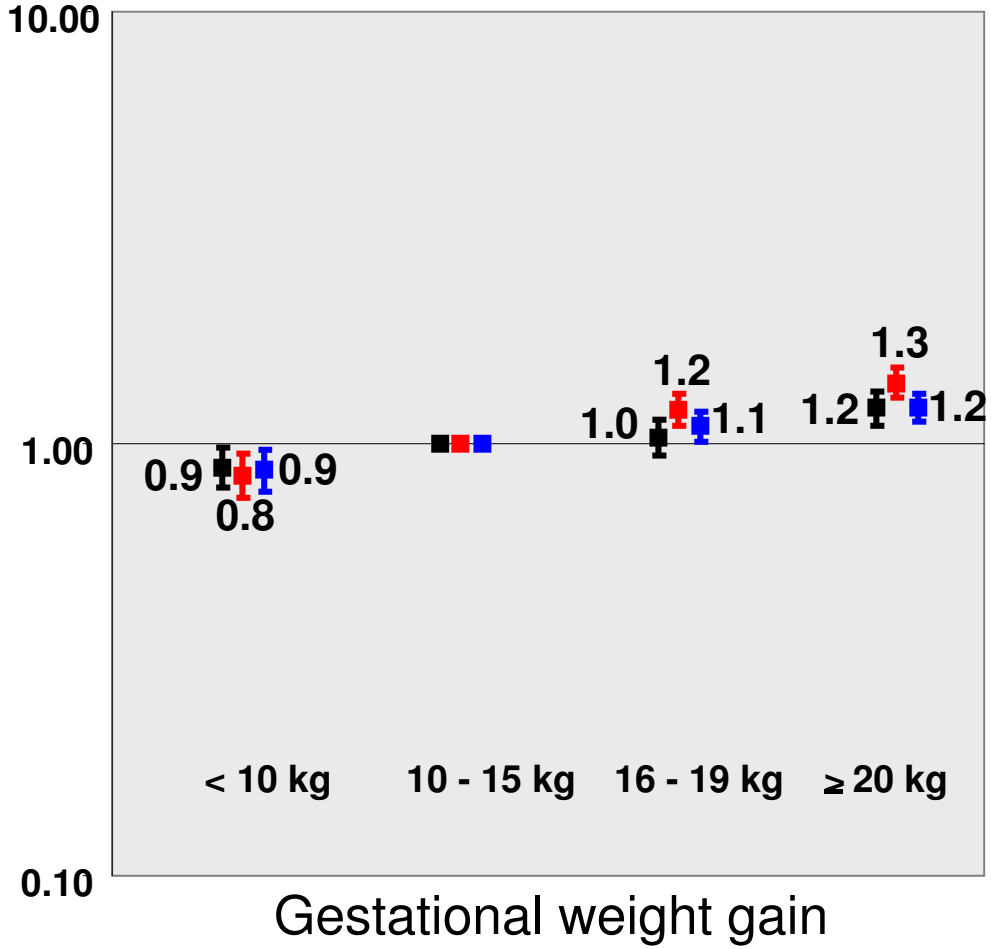
For other women, this proportion is twice as big !

RESULTS 1:

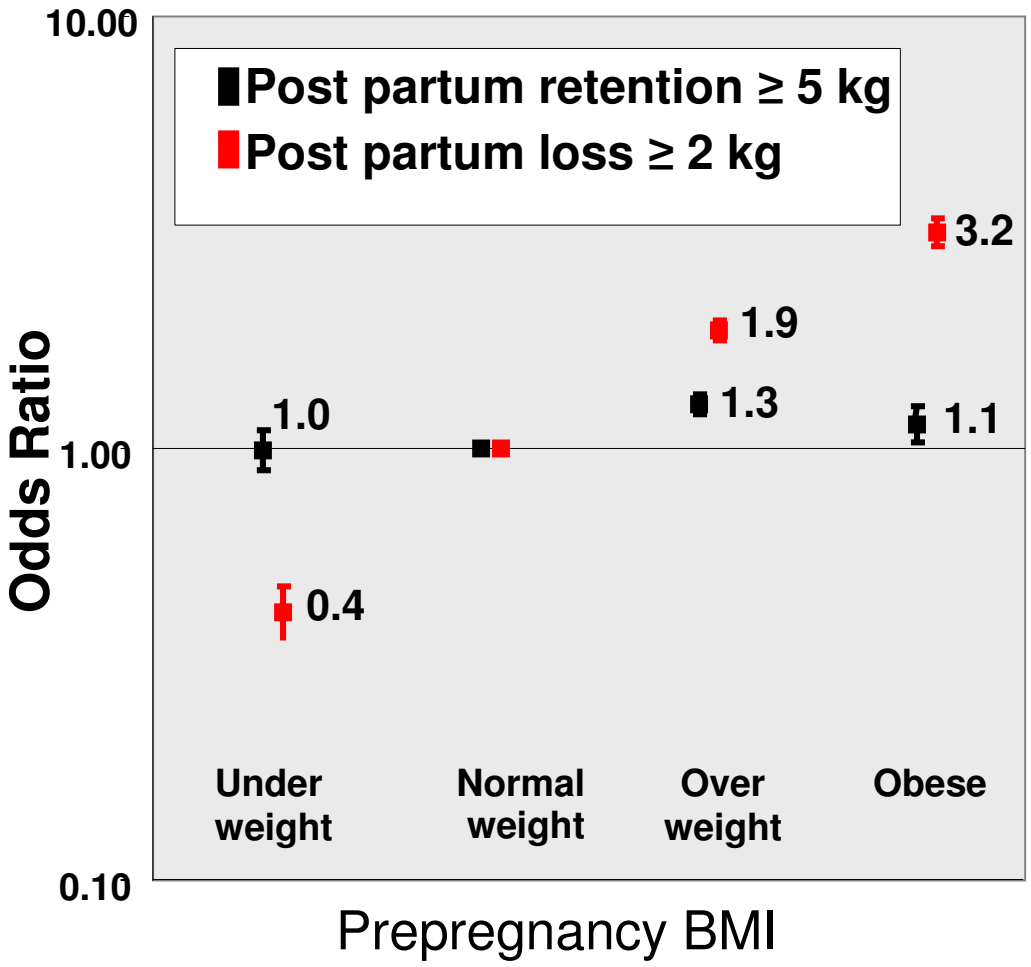
Adjusted odds ratios for pregnancy outcomes

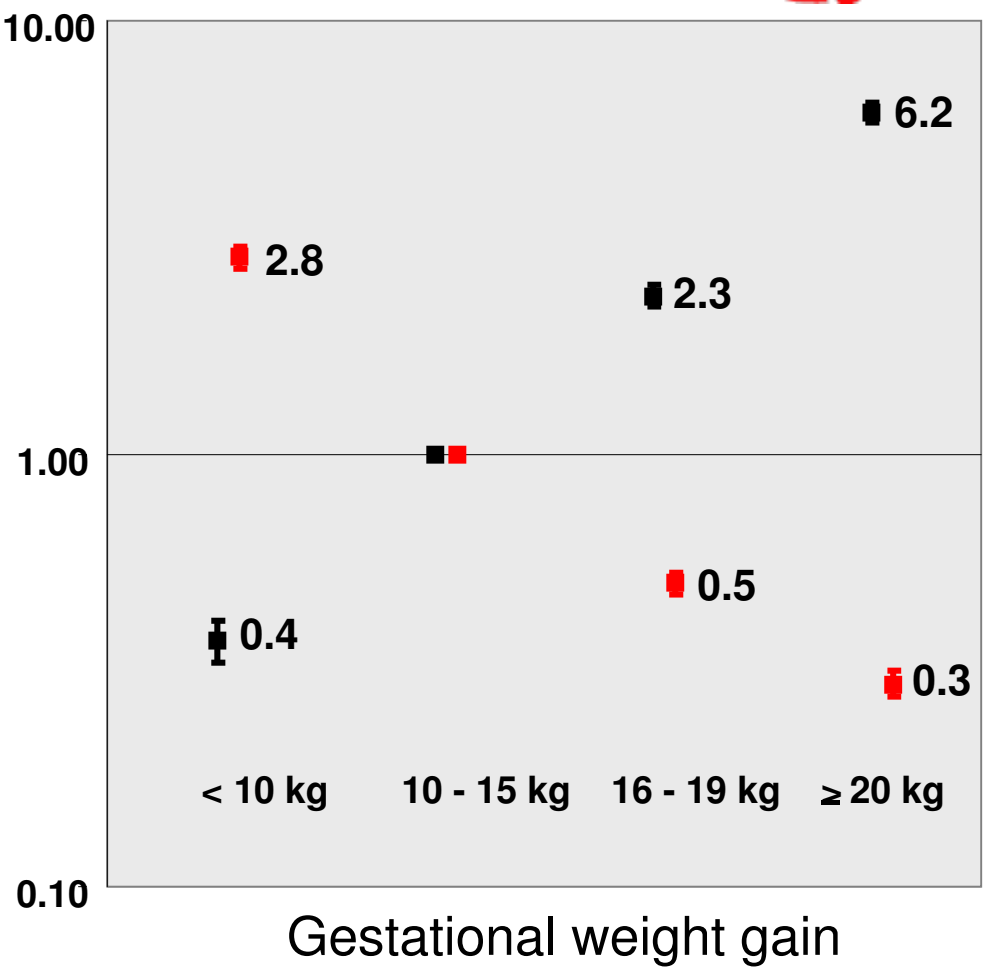
Birth complications





Post partum weight change at 6 months

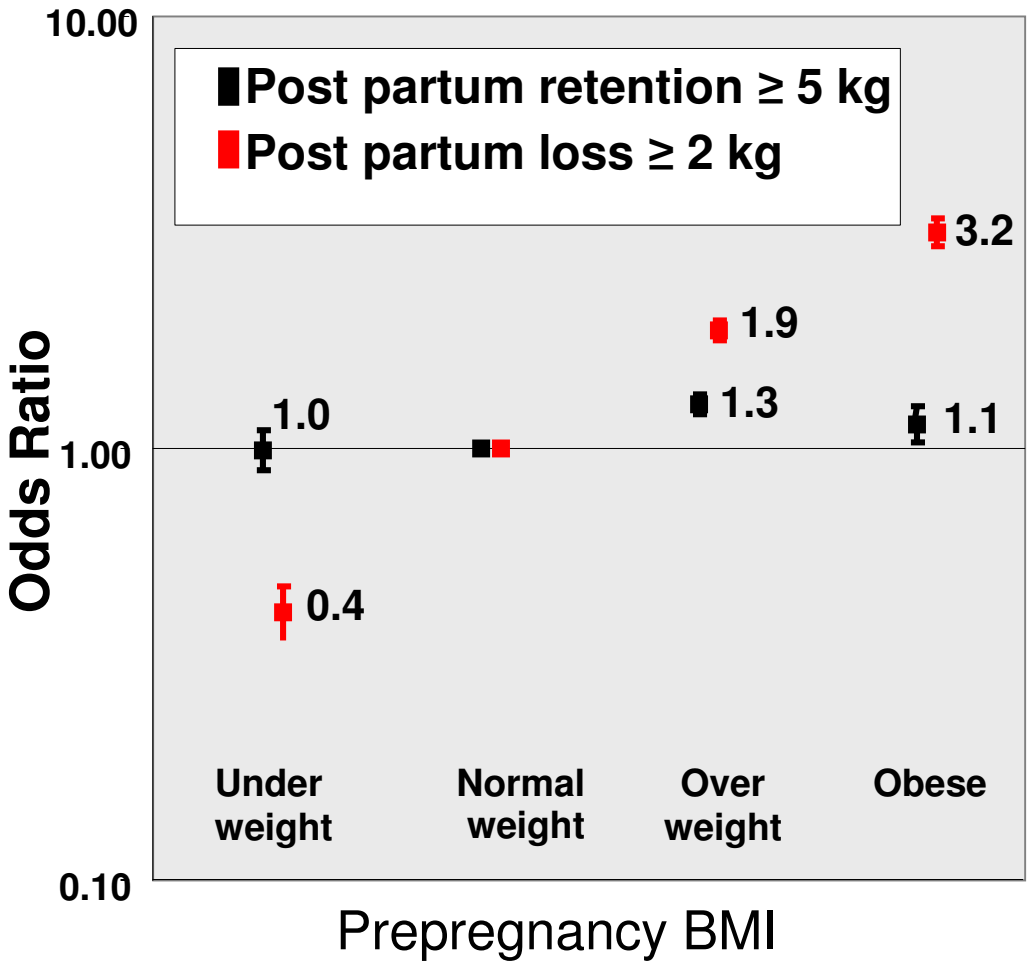


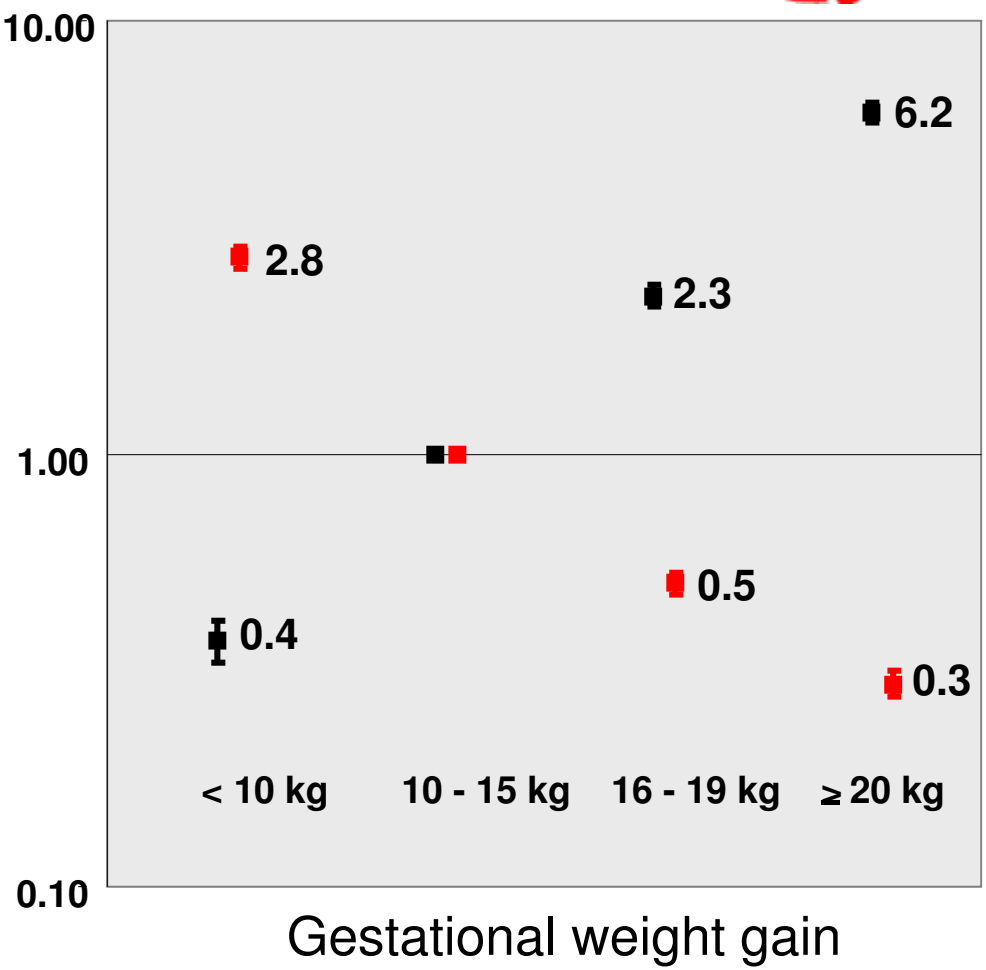


Post partum weight retention was strongly associated with weight gain

Chance of post partum weight loss was equally strongly related to BMI and weight gain.

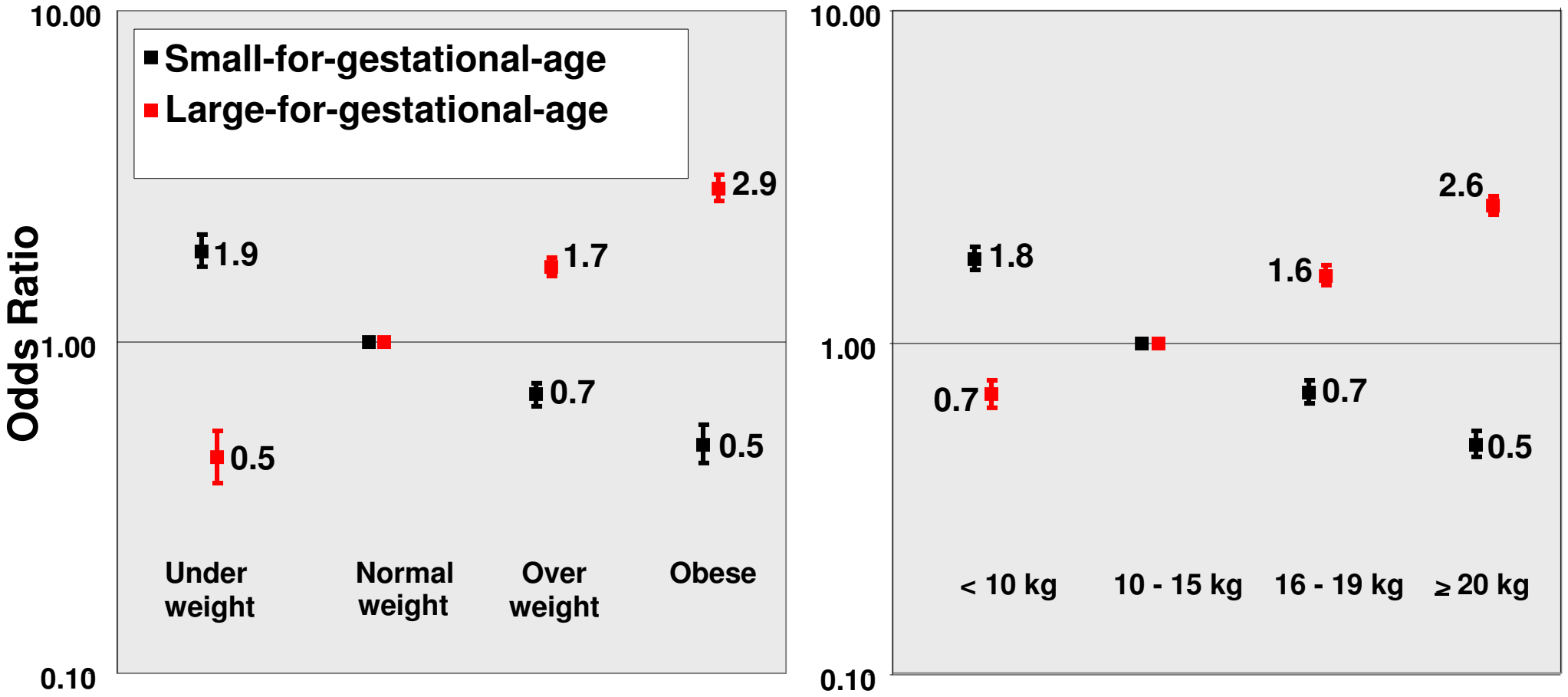
Post partum weight change at 6 months





Striking symmetry for the findings related to gestational weight gain

Neonatal outcomes



One increases while the other decreases in a beautiful symmetric pattern.

Conclusions: Multiplicative models

Danish National Birth Cohort

- Prepregnancy BMI was the strongest predictor of the outcomes under study.
- The contribution of gestational weight gain was modest except for birth weight and post partum weight.
- Only little interaction between BMI and GWG:

  Present for birthweight and post partum weight retention

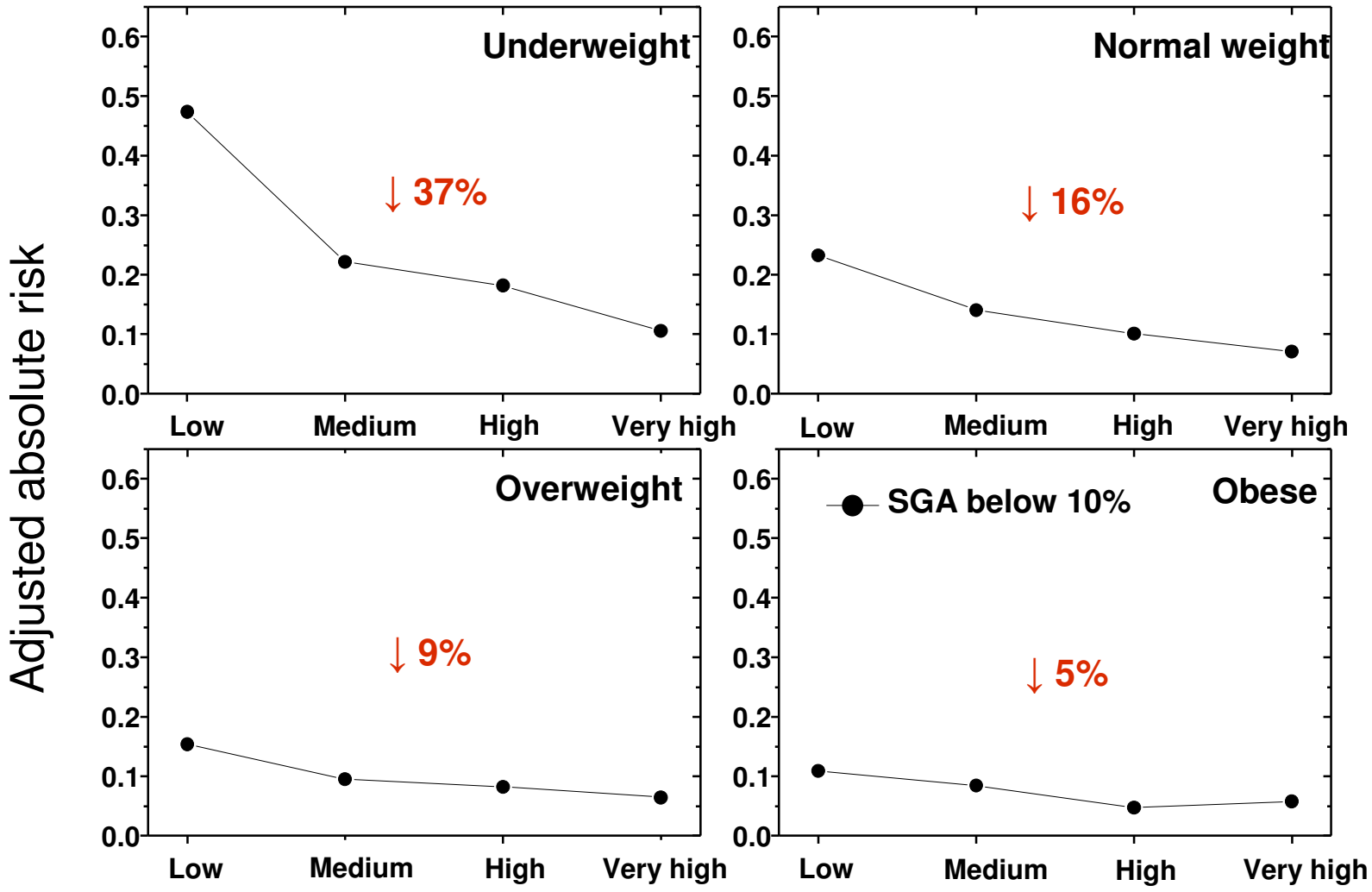
  - Judged to be of little clinical importance…

RESULTS 2

AN ADDITIVE APPROACH:

Comparison of absolute risk differences across BMI groups

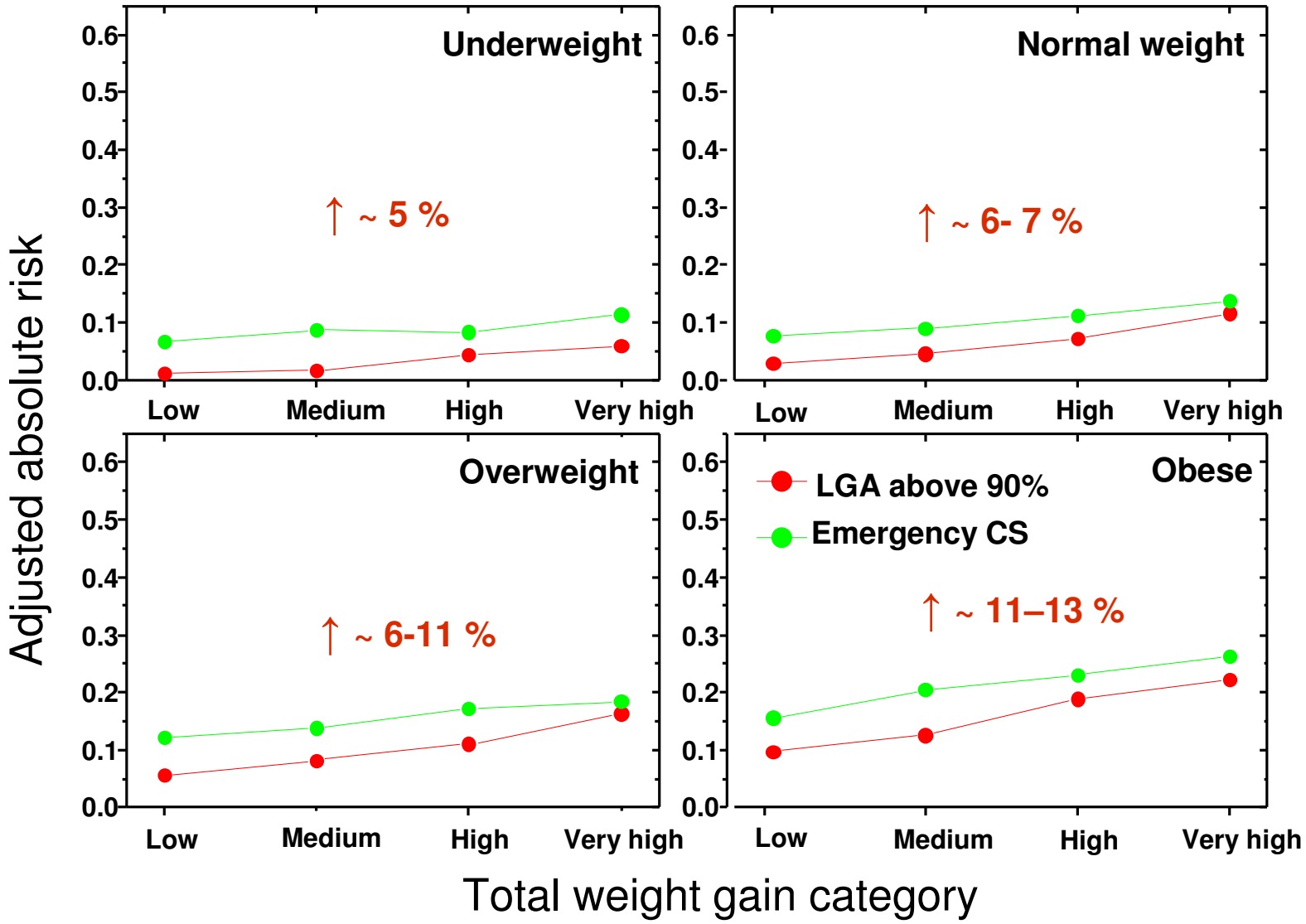
Absolute risk:
Small-for-gestational-age infant



Especially underweight women should avoid lower gains !

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.

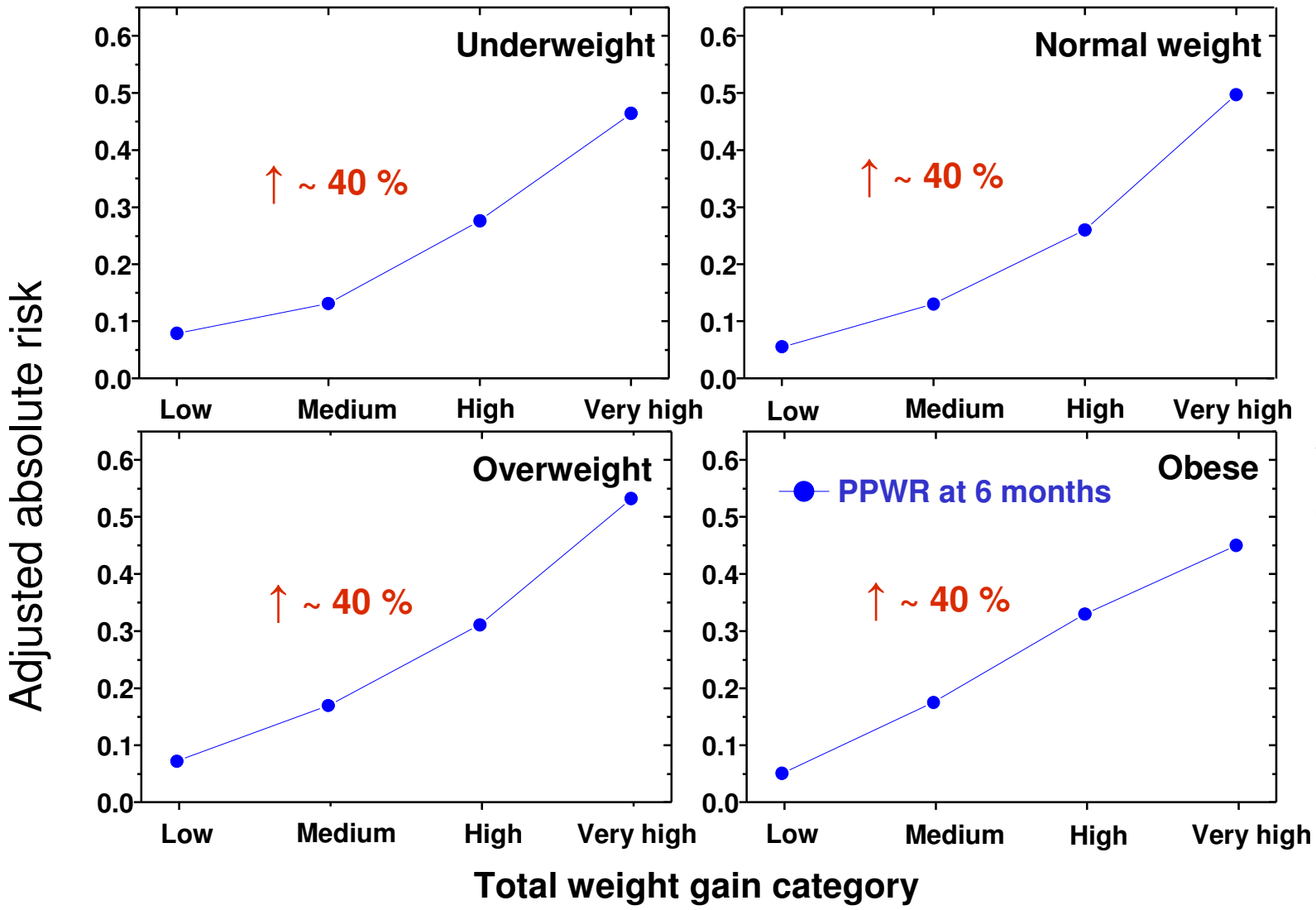
Absolute risks:
Large-for-gestational-age infant and emergency caesarean delivery



Risk differences increase 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

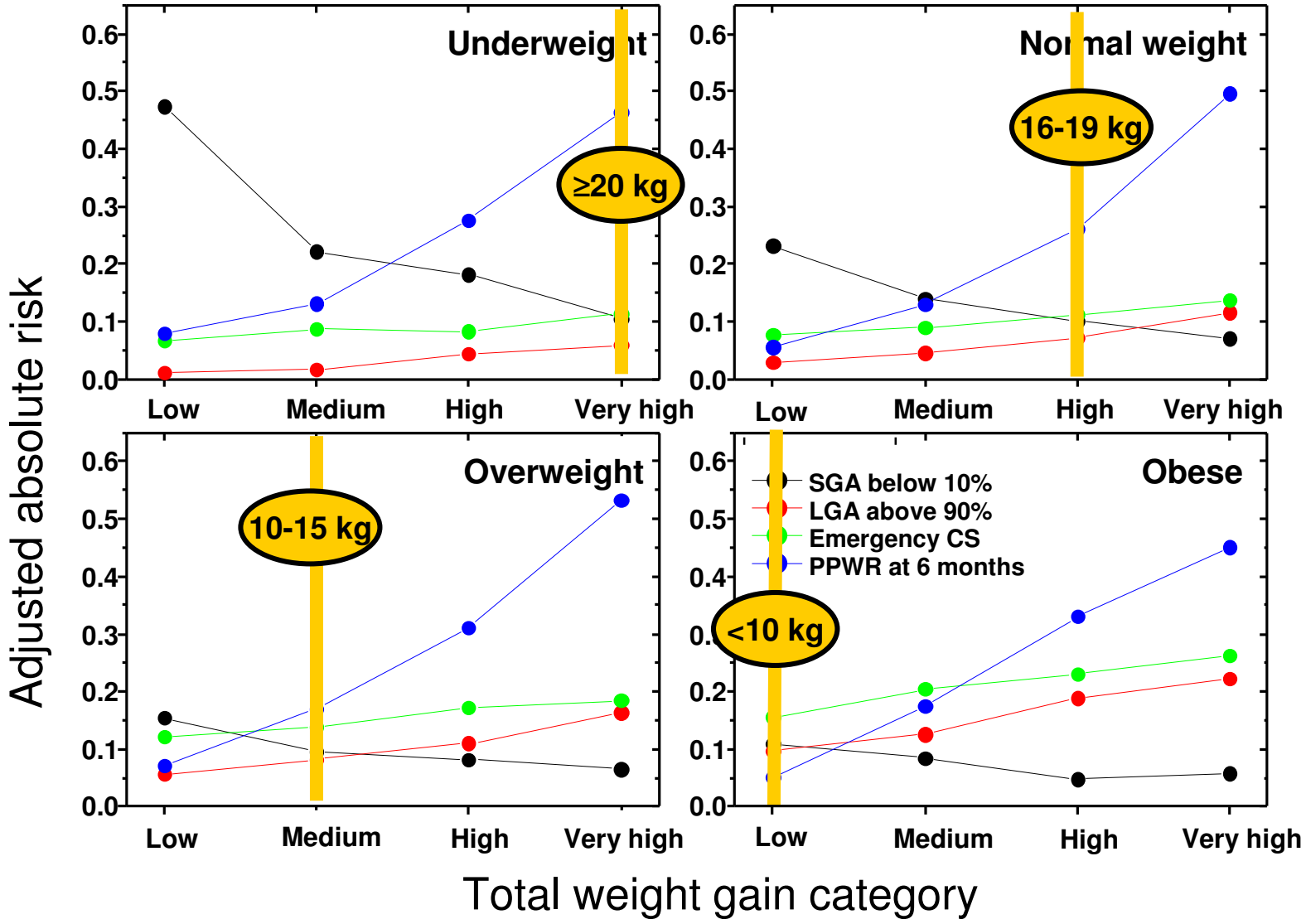


Same risk increase with higher gains.

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:
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.

Conclusions, Absolute risk differences

Danish National Birth Cohort

- Across BMI-groups we saw
  - Highly varying background risks.
  - Highly varying risk differences when going from low to higher gains.
- Makes it possible to identify high-risk groups that could be candidates for public health intervention.
- Supports the idea of BMI-specific recommendations:
  - Underweight women may benefit from very high gain of > 20 kg.
  - Obese women may benefit from low gain < 10 kg.

RESULTS 3:

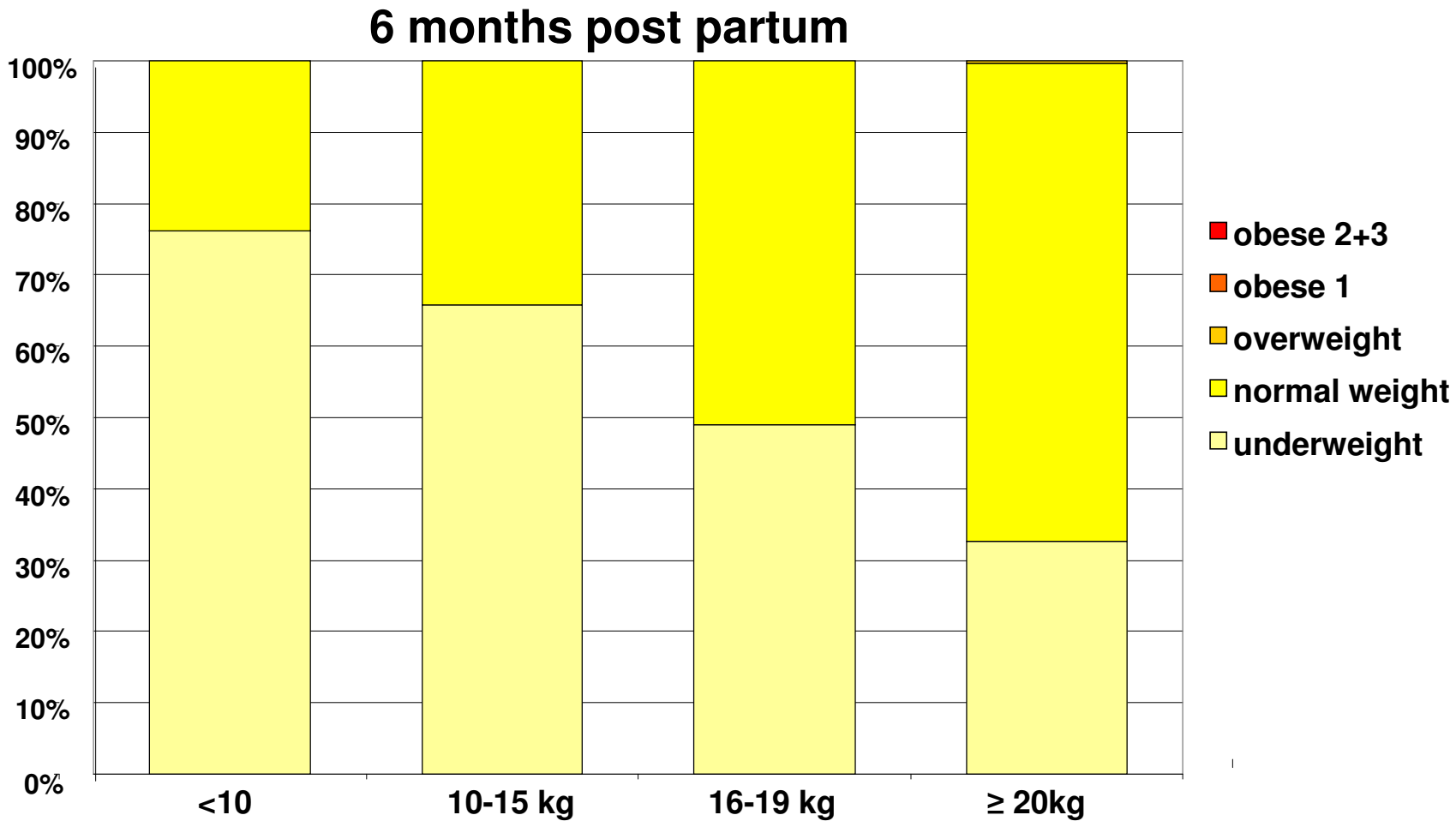
Migration in BMI groups according to GWG

BMI-migration in underweight women according to GWG

Danish National Birth Cohort

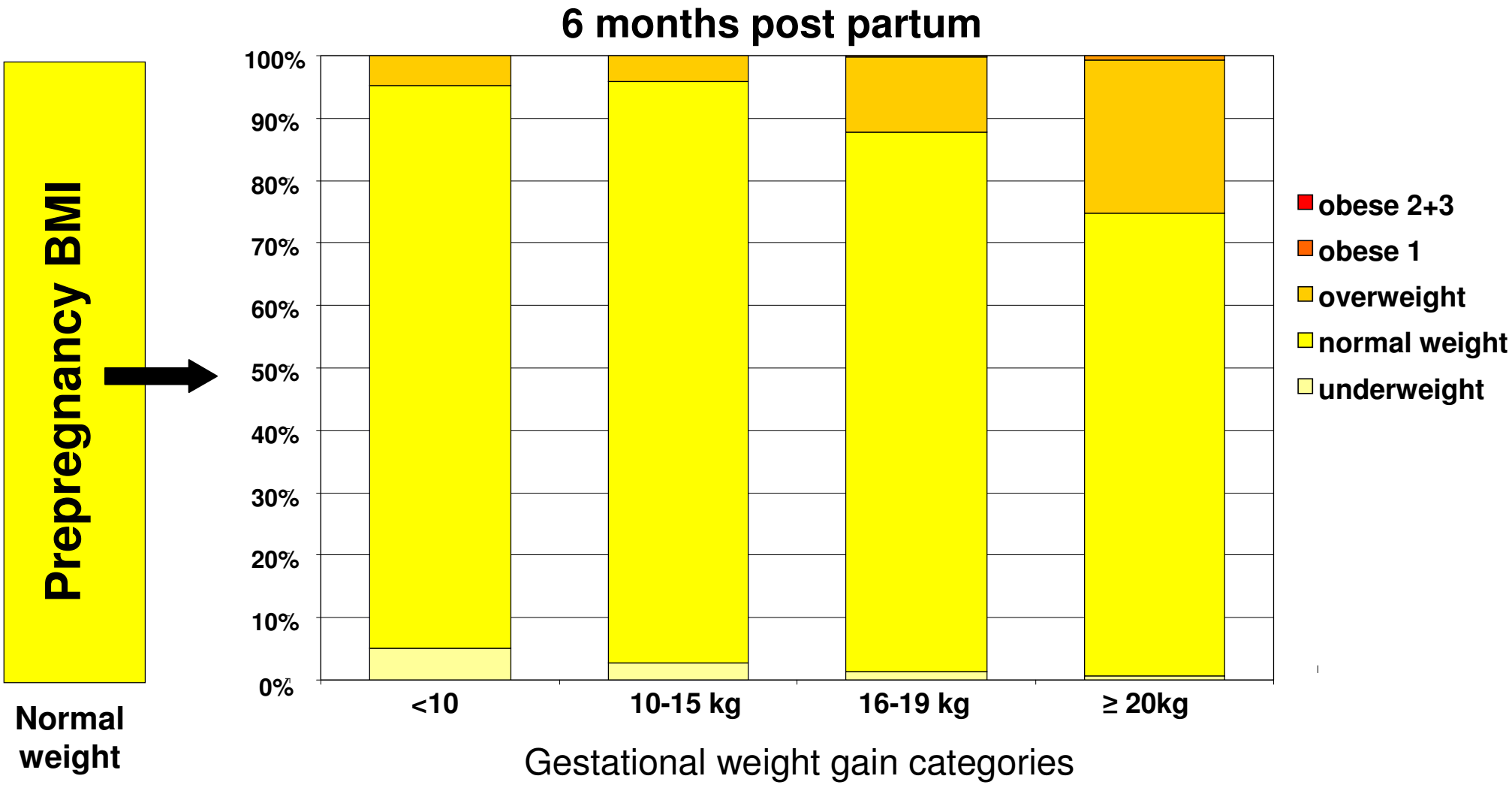
Prepregnancy BMI

Under weight



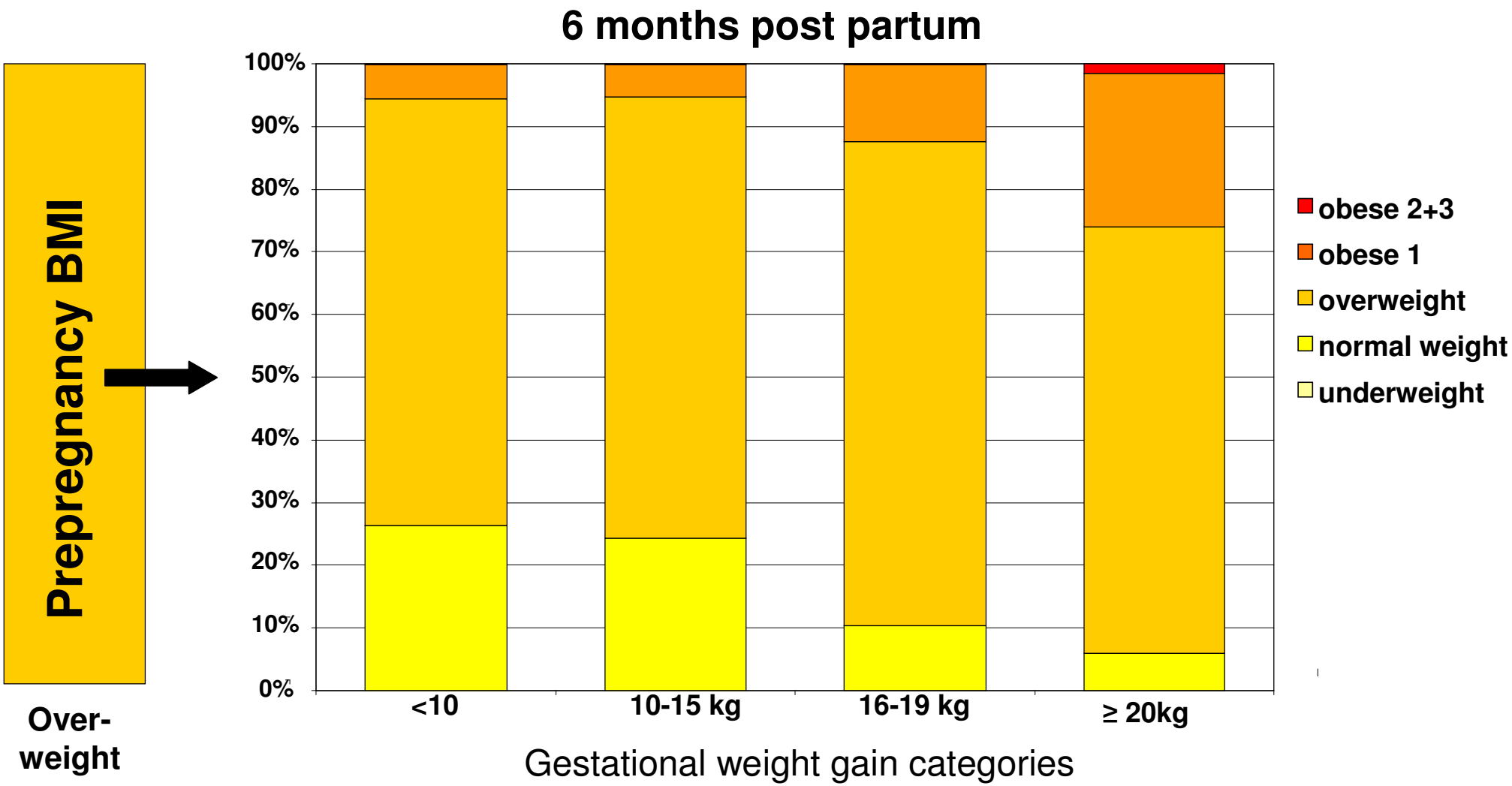
BMI-migration in normal-weight women according to GWG

Danish National Birth Cohort



BMI-migration in overweight women according to GWG

Danish National Birth Cohort

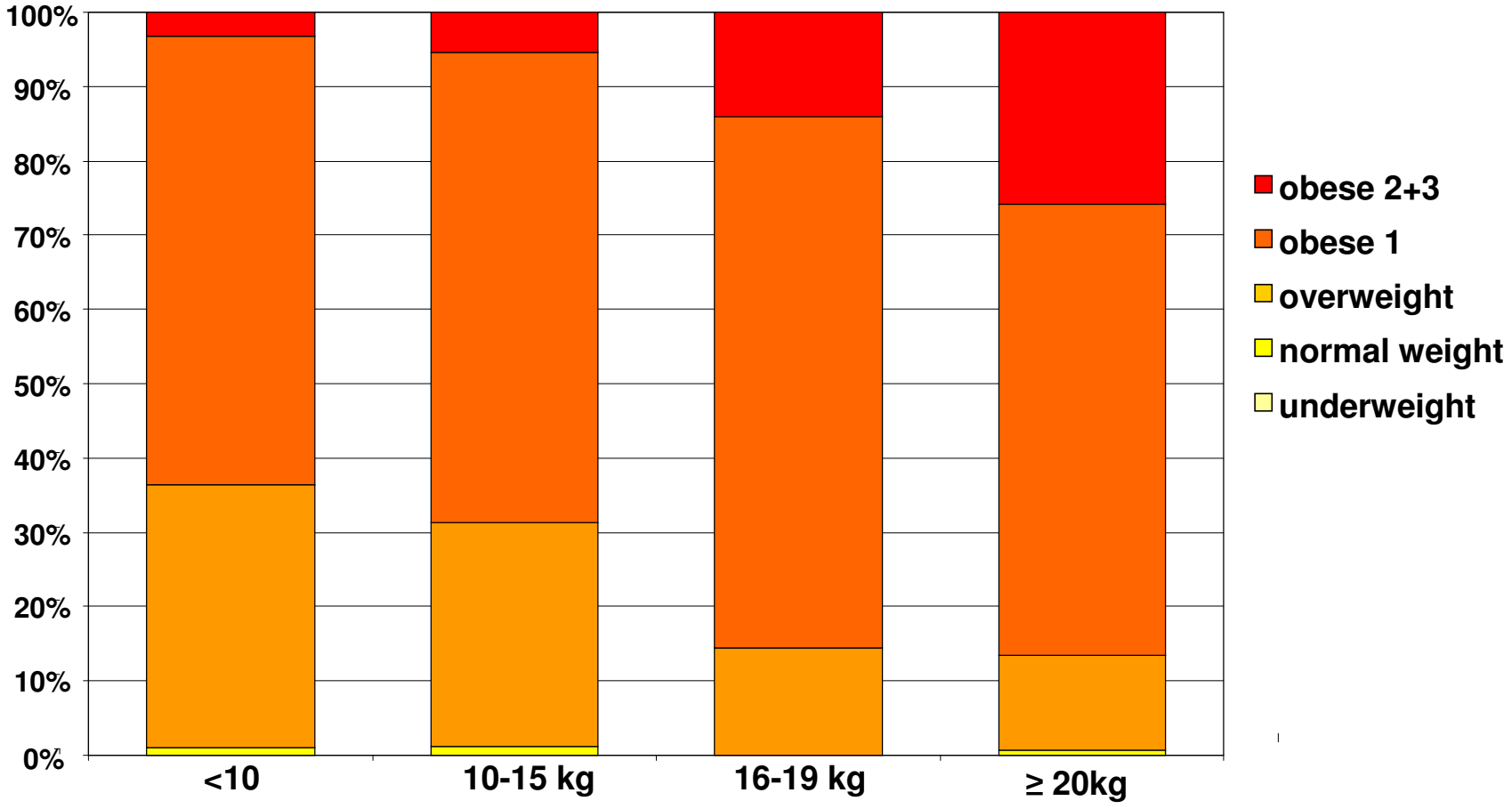


BMI-migration in obese class 1 women according to GWG

Danish National Birth Cohort

Prepregnancy BMI

Obese class 1

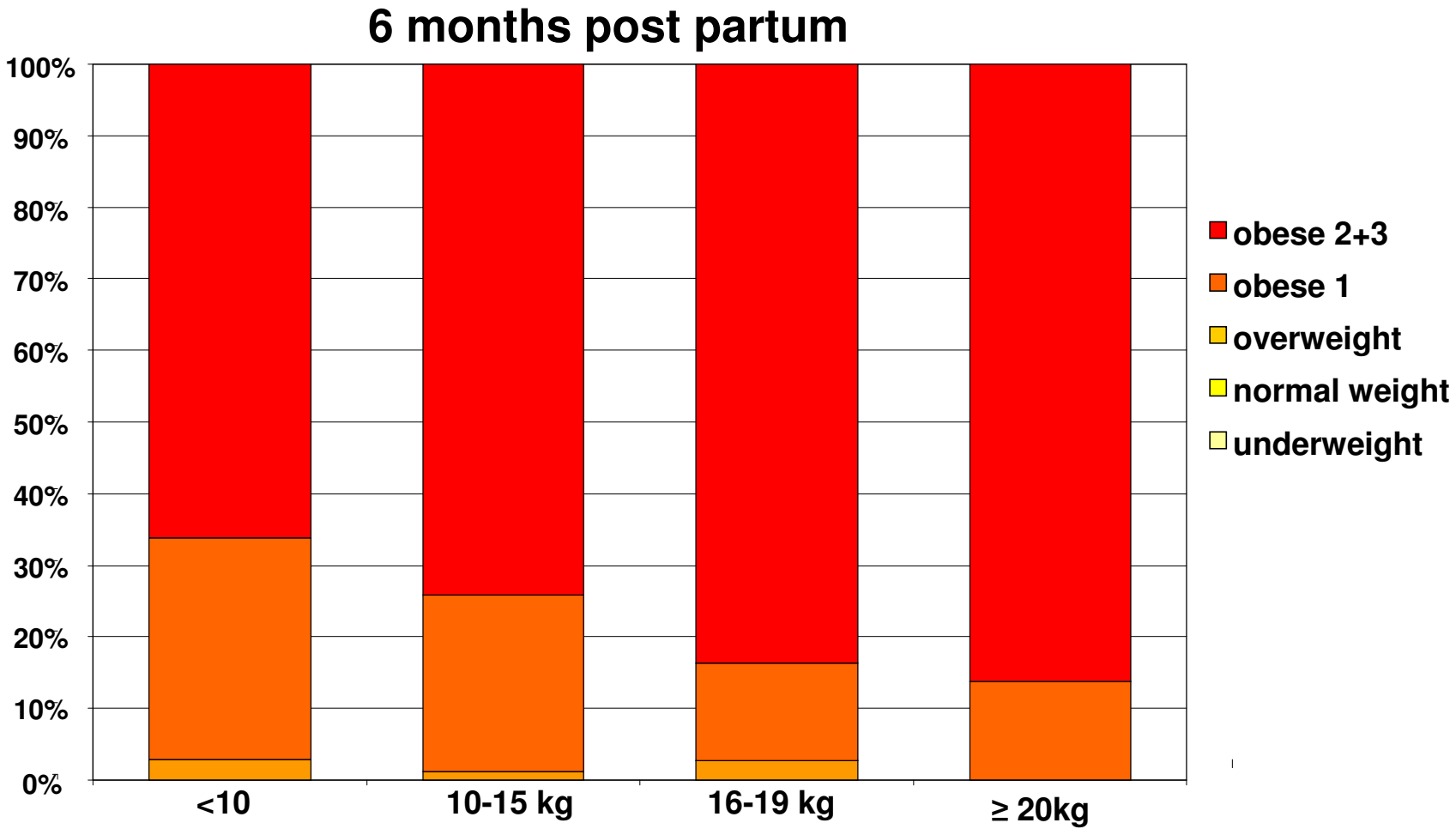


BMI-migration in obese class 2+3 women according to GWG

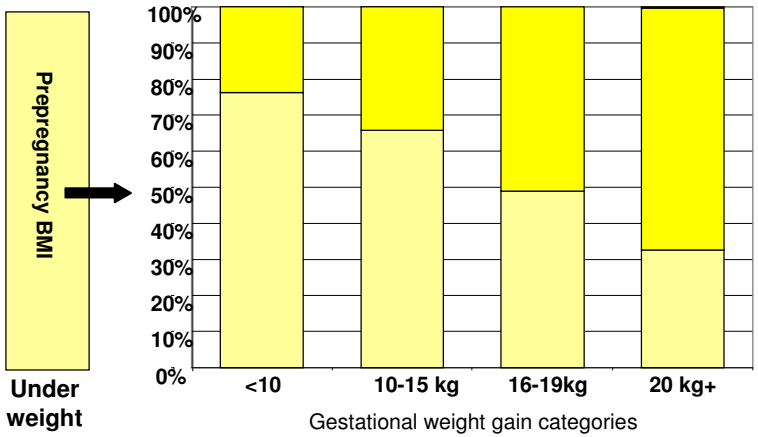
Danish National Birth Cohort

Prepregnancy BMI

Obese class 2+3

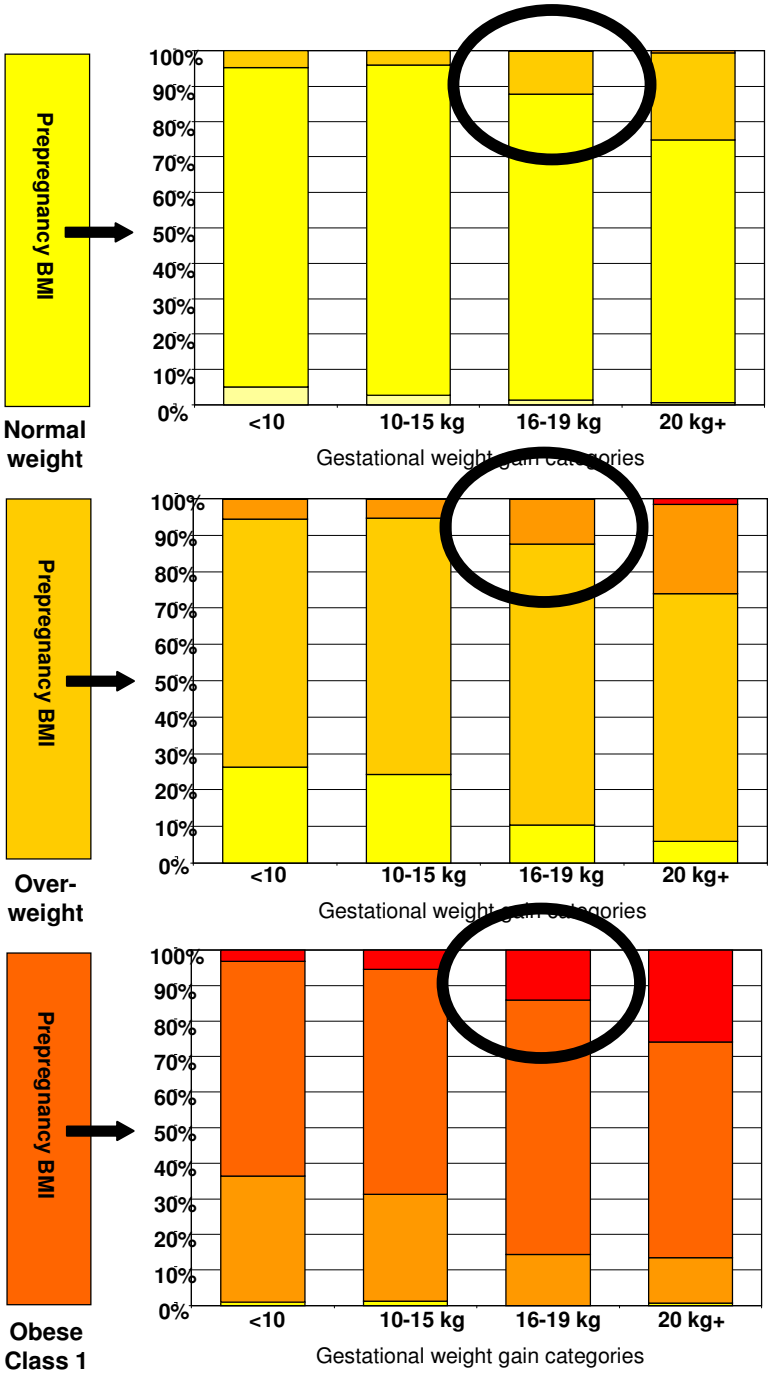


Migration conclusions



Higher gains in underweight women:

Do not put them in risk of becoming overweight
– only normalize them.



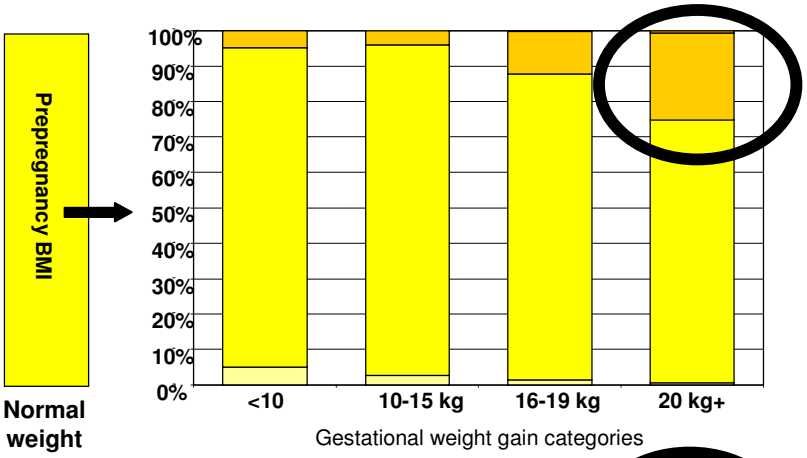
Migration conclusions

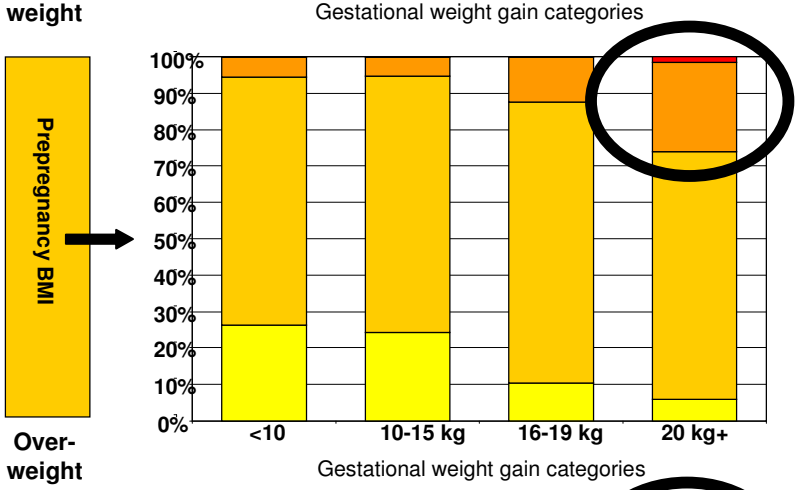
Danish National Birth Cohort

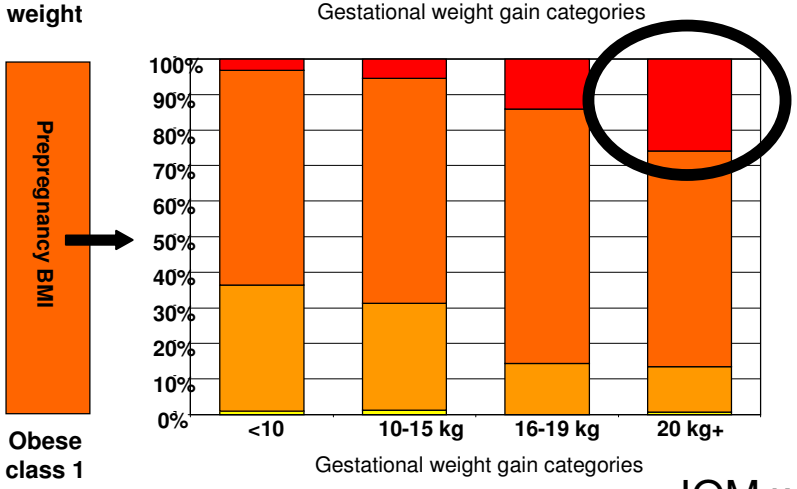
High gain of 16-19 kg:

~ 13 % of
- normal weight,
- overweight,
- obese women

moved up 1 BMI category !







Migration conclusions

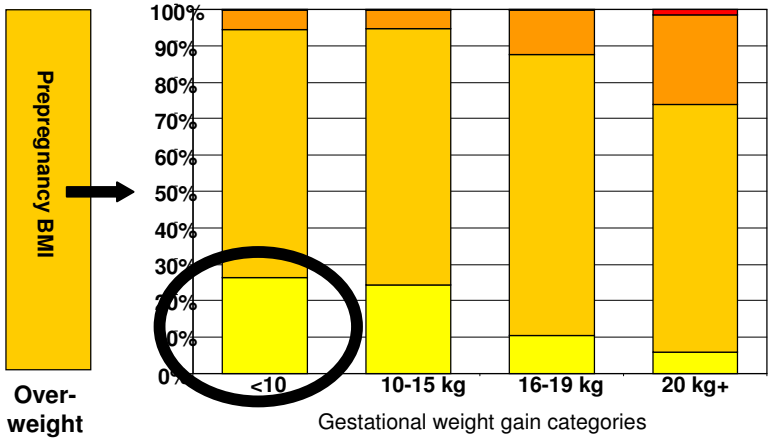
Danish National Birth Cohort

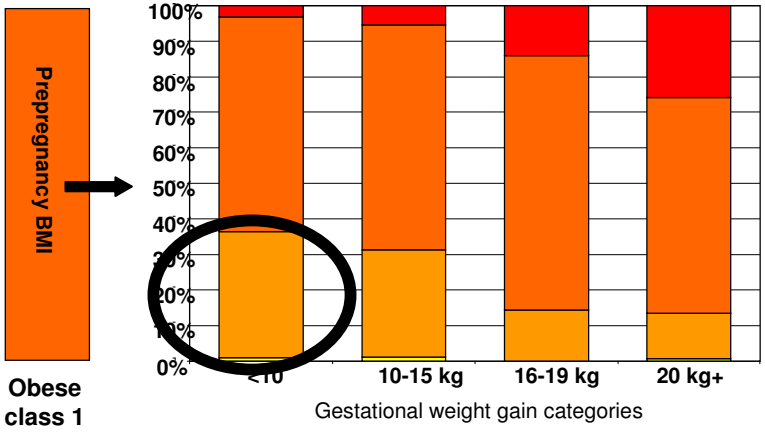
Very high gain of ≥ 20 kg:

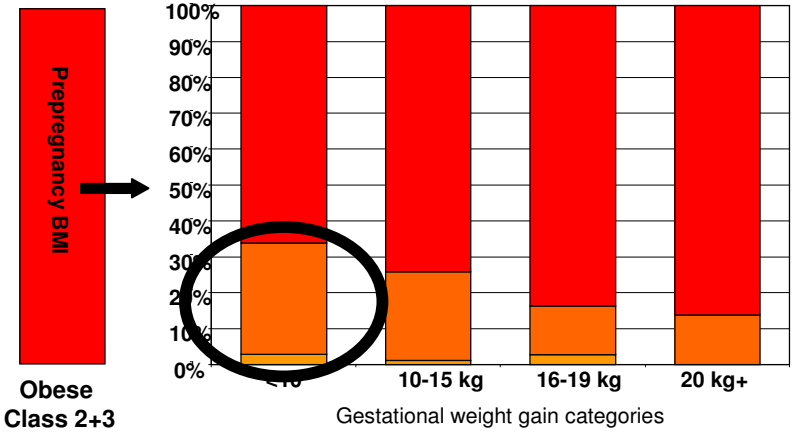
~ 25% of
- normal weight,
- overweight,
- obese women

moved up 1 BMI category !

Migration conclusions







Low gain of < 10 kg:

25% of overweight
moved down 1 BMI category !

33% of obese and extremely obese
moved down 1 BMI category !

Main conclusions

Danish National Birth Cohort

- 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 consequenses.

  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.