# The association between an unhealthy childhood diet and body composition depends on prenatal experience

Sarah Crozier, Janis Baird, Hazel Inskip, Nick Harvey, Sian Robinson, Cyrus Cooper, Mark Hanson and Keith Godfrey

Medical Research Council Lifecourse Epidemiology Unit, Southampton, UK

MRC Lifecourse Epidemiology Unit

Southampton Women's Survey

University of Southampton School of Medicine

# Introduction

- The prevalence of obesity is rising in children and is associated with both childhood ill health and an increased risk of subsequent adult obesity
- Intrauterine life may be a critical period for the programming of later obesity
- The developmental mismatch hypothesis proposes that risk of diseases such as obesity is increased when impaired prenatal nutrition and growth, is followed by an unhealthy childhood diet.

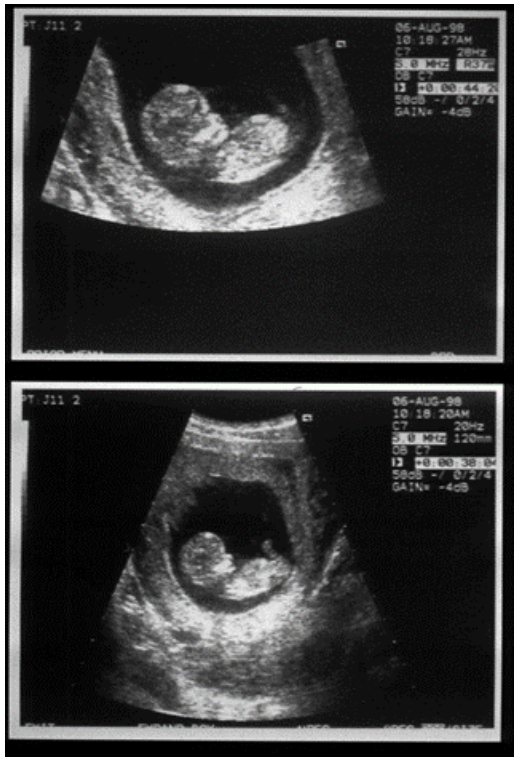
# Southampton Women's Survey

12,583 non-pregnant Southampton women aged 20-34, interviewed about diet, physical activity, social circumstances and lifestyle.

3,158 live-born singleton births.

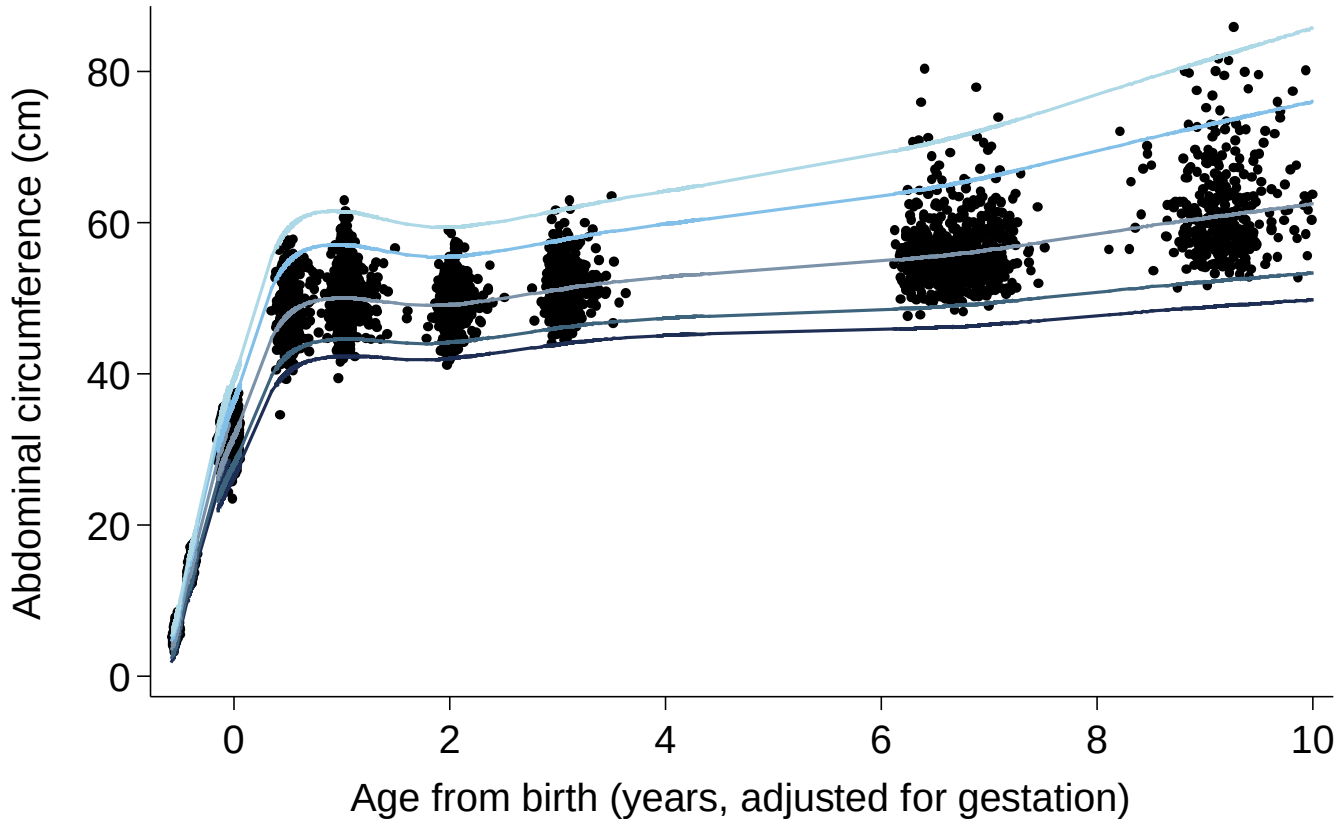
Offspring followed through pregnancy, infancy and beyond.

# Abdominal circumference



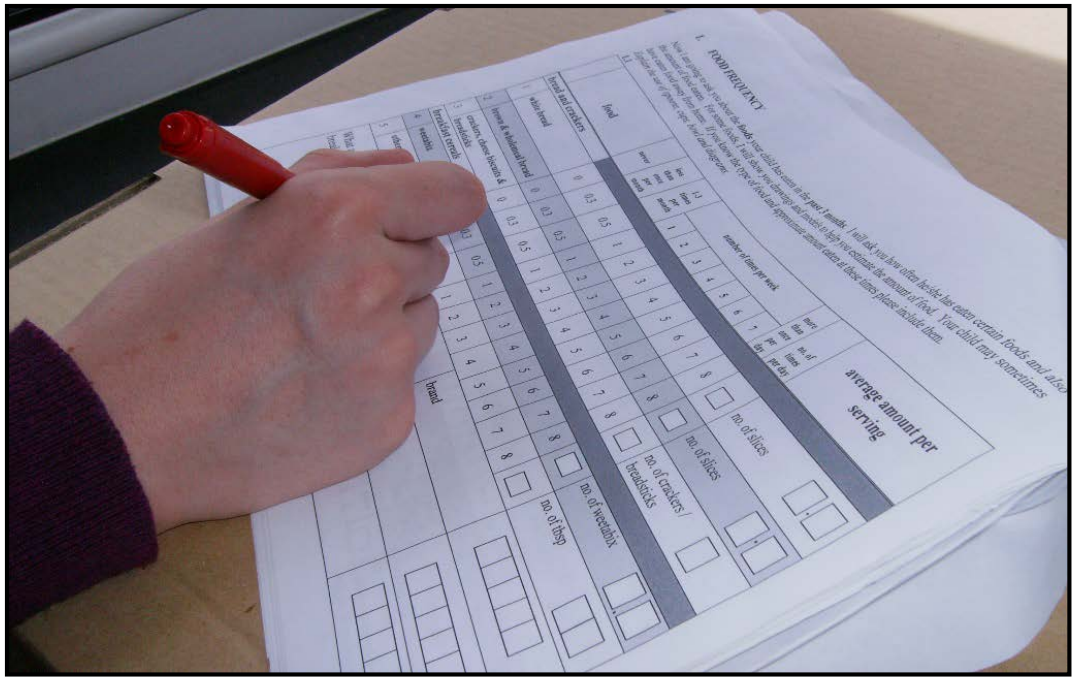
Abdominal circumference was measured at 11 weeks, 19 weeks, 34 weeks, birth, 6 months, 1 year, 2 years, 3 years, 6-7 years and 9 years.

# AC size z-scores




Lines are mean, □2 SDs and □3 SDs

# Food frequency questionnaire




- The broad pattern of 6 year diet has been characterised by the use of a prudent diet score.

# Principal component analysis

| | Weighting | | Frequency (per week) | | Total |
|---|---|---|---|---|---|
| Green vegetables | 0.33 | × | 7 | = | 2.3 |
| Salad vegetables | 0.25 | × | 4.5 | = | 1.1 |
| White bread | -0.20 | × | 0.3 | = | -0.1 |
| Crisps | -0.21 | × | 0.5 | = | -0.1 |
| | | | | | Total = 3.2 |

# Median frequency per week food intake by quarters of the 6 year prudent diet score

| Food | Least prudent quarter | Most prudent quarter |
|---|---|---|
|  Salad vegetables | 0.8 | 6 |
|  Green vegetables | 2.3 | 6.5 |
|  Root vegetables | 2 | 4.3 |
|  Other vegetables | 0.5 | 2 |
|  Crisps | 5 | 2 |
|  Processed meat | 7 | 4.8 |
|  White bread | 7 | 1 |
|  Chips and roast potatoes | 3 | 1.5 |

# Outcomes

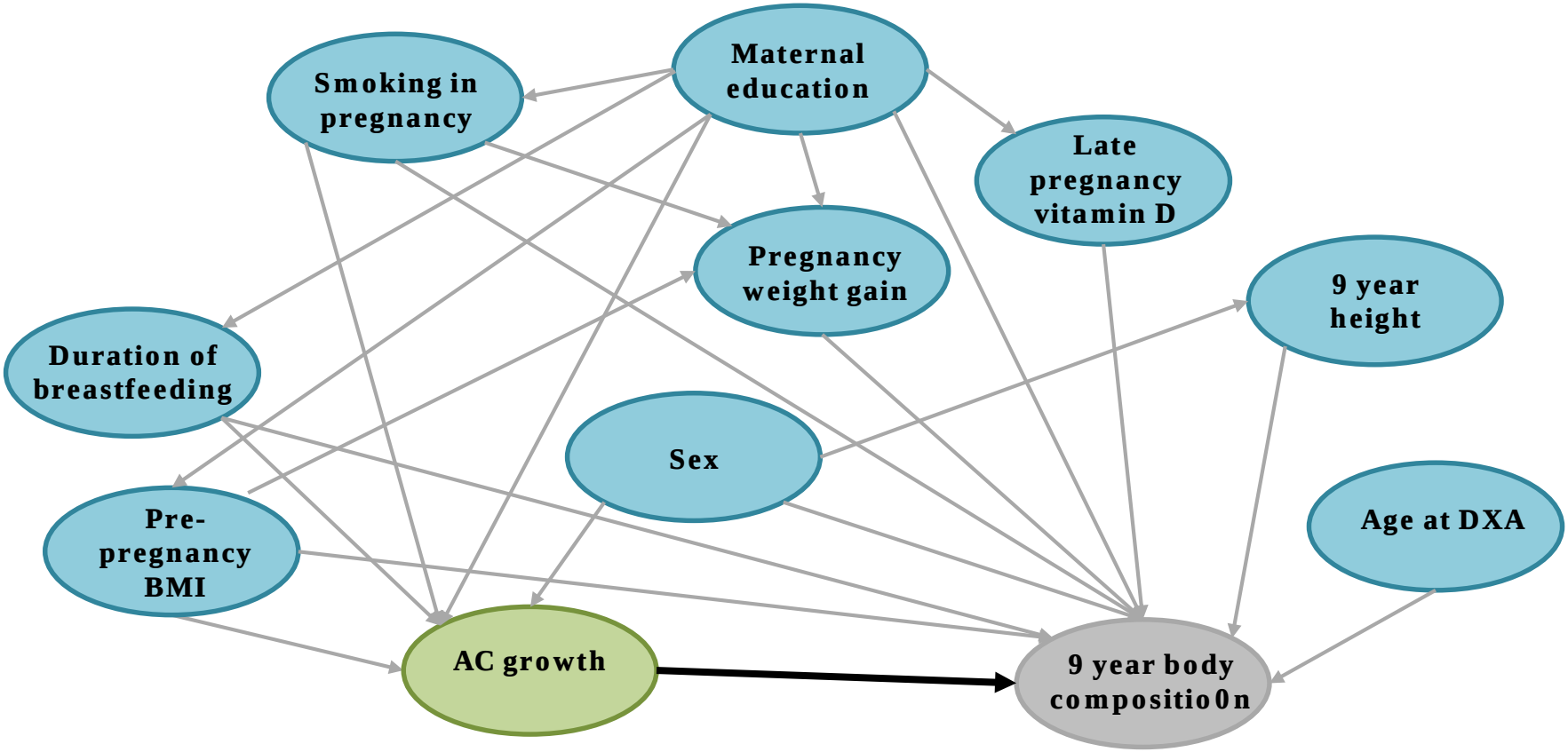
- Dual-energy X-ray Absorptiometry (DXA) was used to assess body composition at 9 years; fat, lean and bone mass were derived using paediatric software.

- 592 children included in the analysis.

# Directed Acyclic Graphs

- An analysis can stand or fall on the choice of confounders
- A Directed Acyclic Graph (DAG) or causal diagram describes a model of the associations between all variables that could influence the exposure-outcome association.

# DAG



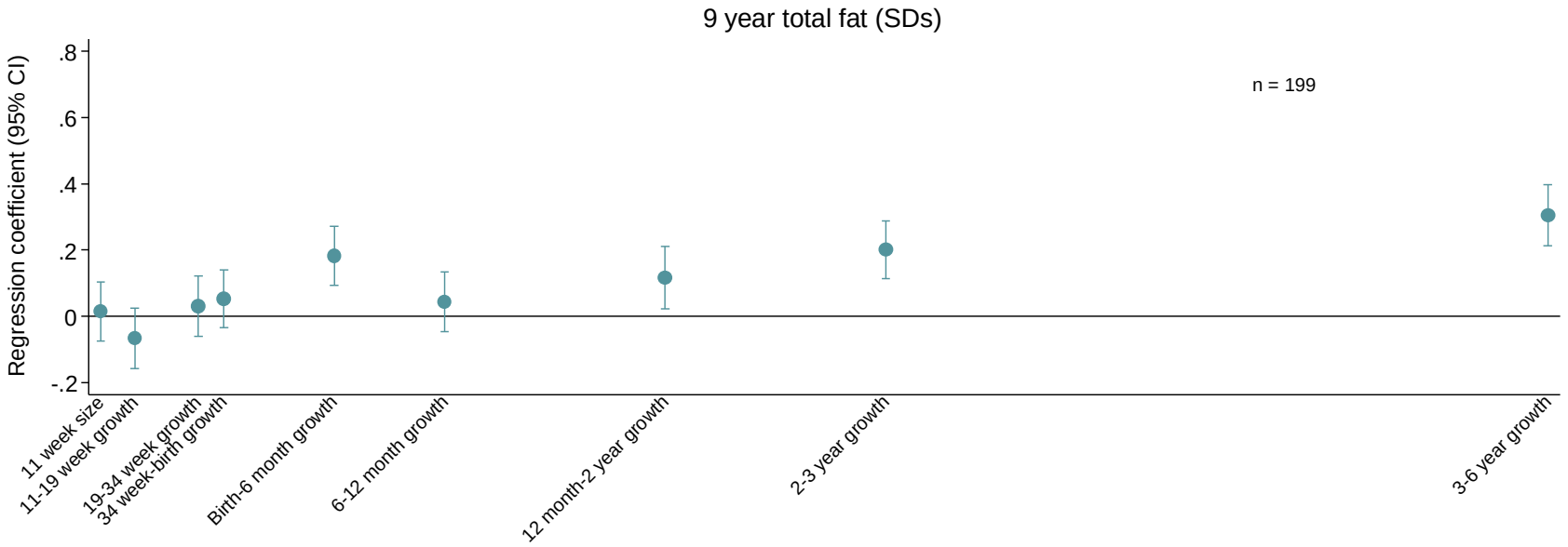

- Adjust for: 9 year height, sex, breastfeeding duration, maternal BMI, education, smoking in pregnancy, late pregnancy vitamin D and pregnancy weight gain

# Characteristics

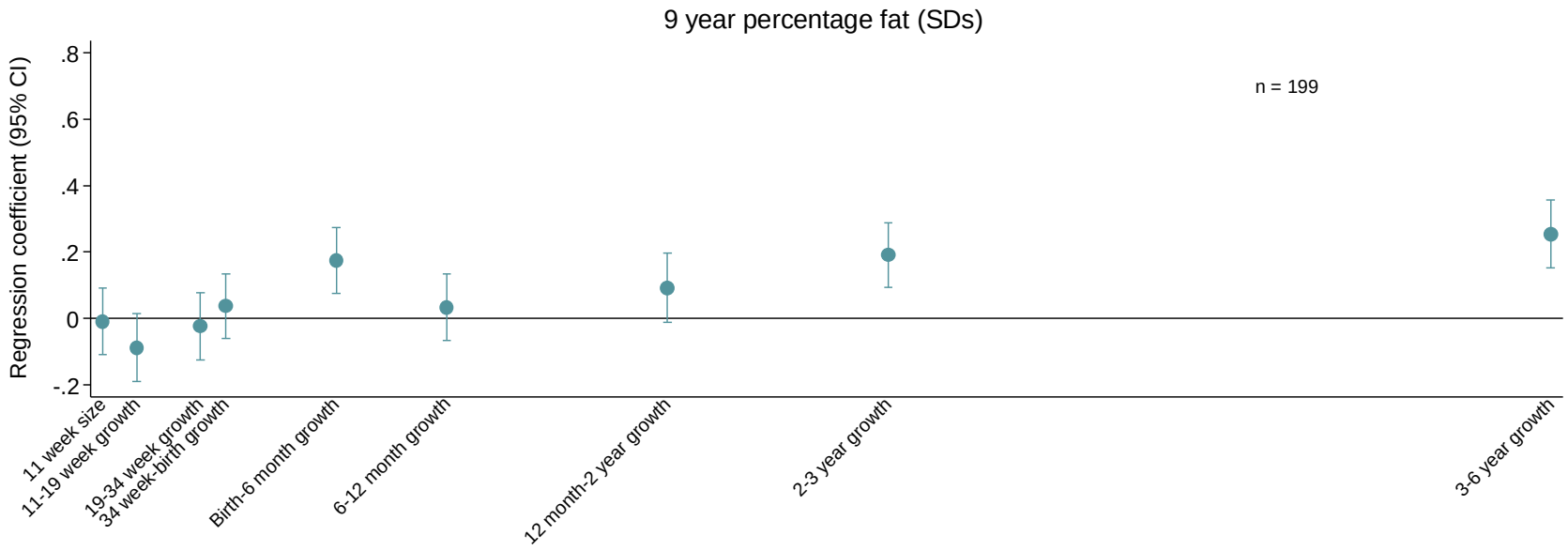
n = 592

| Characteristic | |
|---|---|
| Maternal education ≥ A-levels, n (%) | 376 (63.6%) |
| Pre-conception BMI, kg/m$^2$ [median (IQR)] | 24.0 (22.1 to 27.0) |
| Female, n (%) | 303 (48.8%) |
| Age at DXA scan, years [mean (SD)] | 9.2 (0.3) |
| 9 year total fat, kg [median (IQR)] | 7.6 (5.7, 10.0) |
| 9 year total lean, kg [mean (SD)] | 22.7 (3.3) |
| 9 year total BMC, kg [mean (SD)] | 1.0 (0.1) |

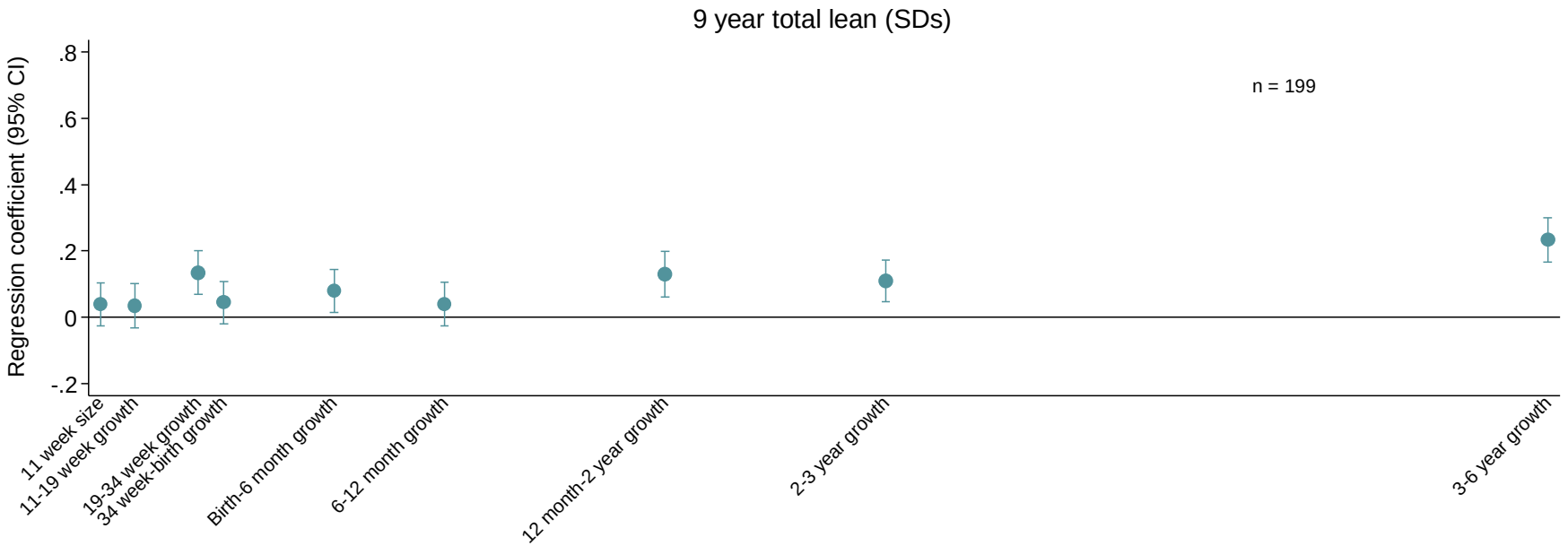
# Main effects - fat mass



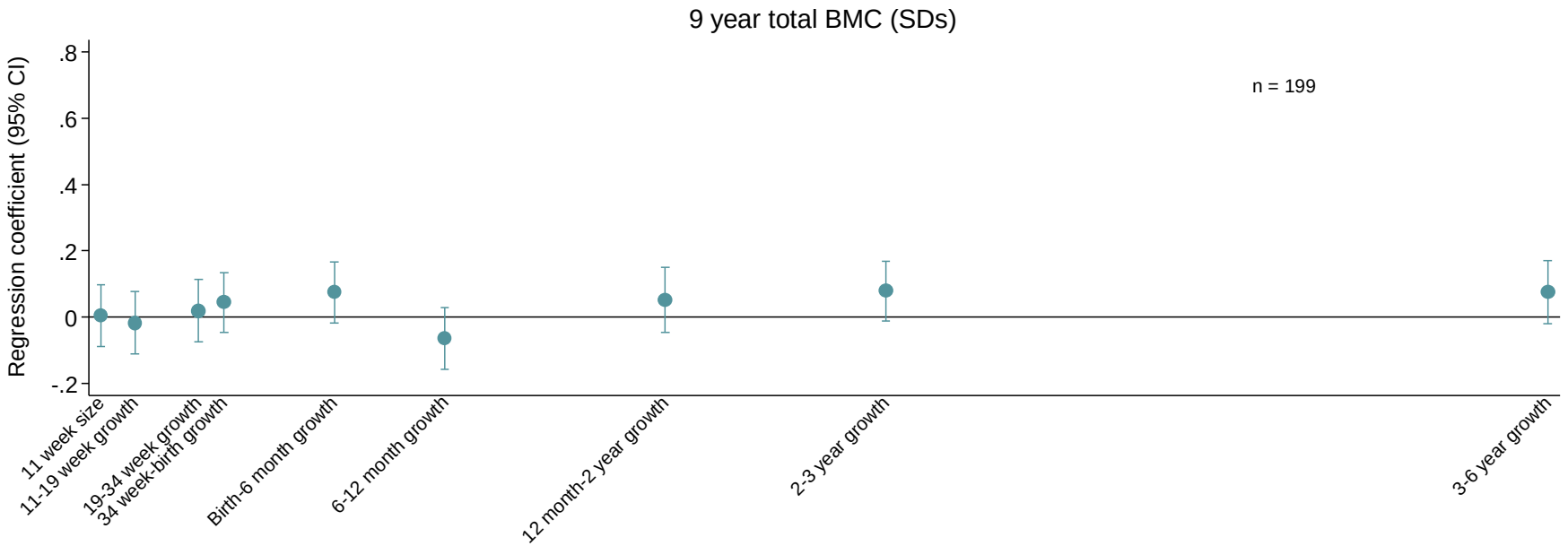
# Main effects – percentage fat



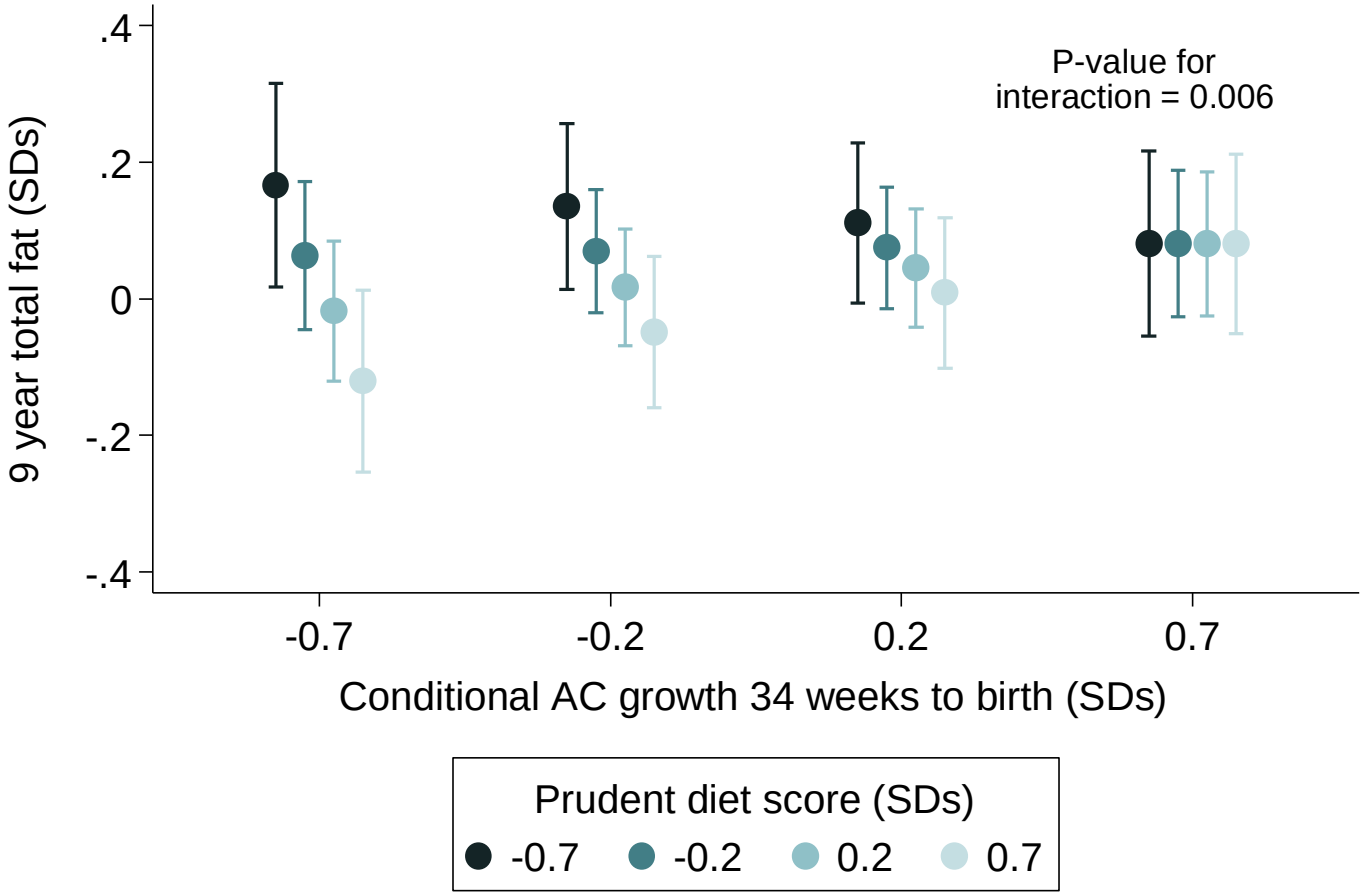
# Main effects – total lean



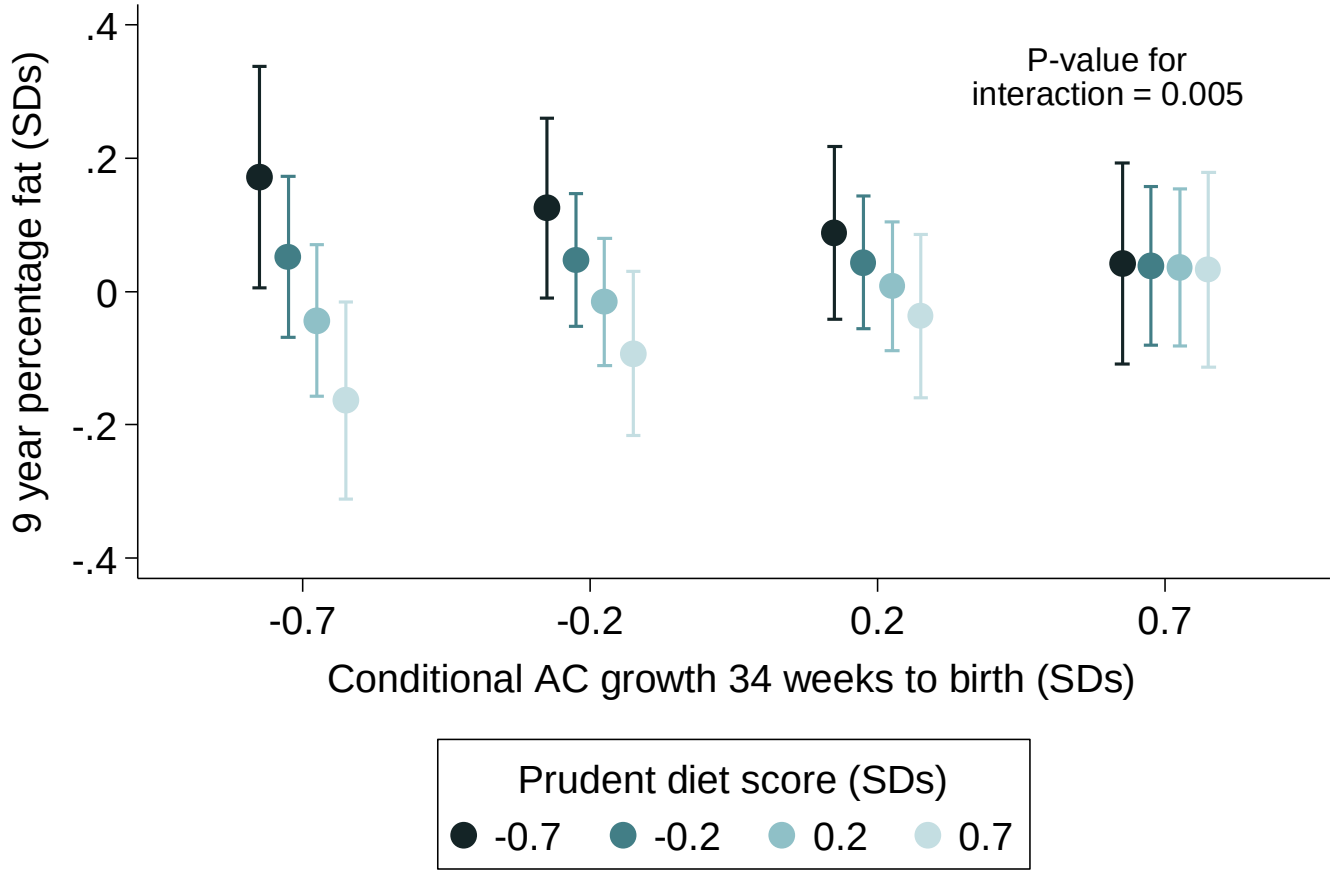
# Main effects – total BMC



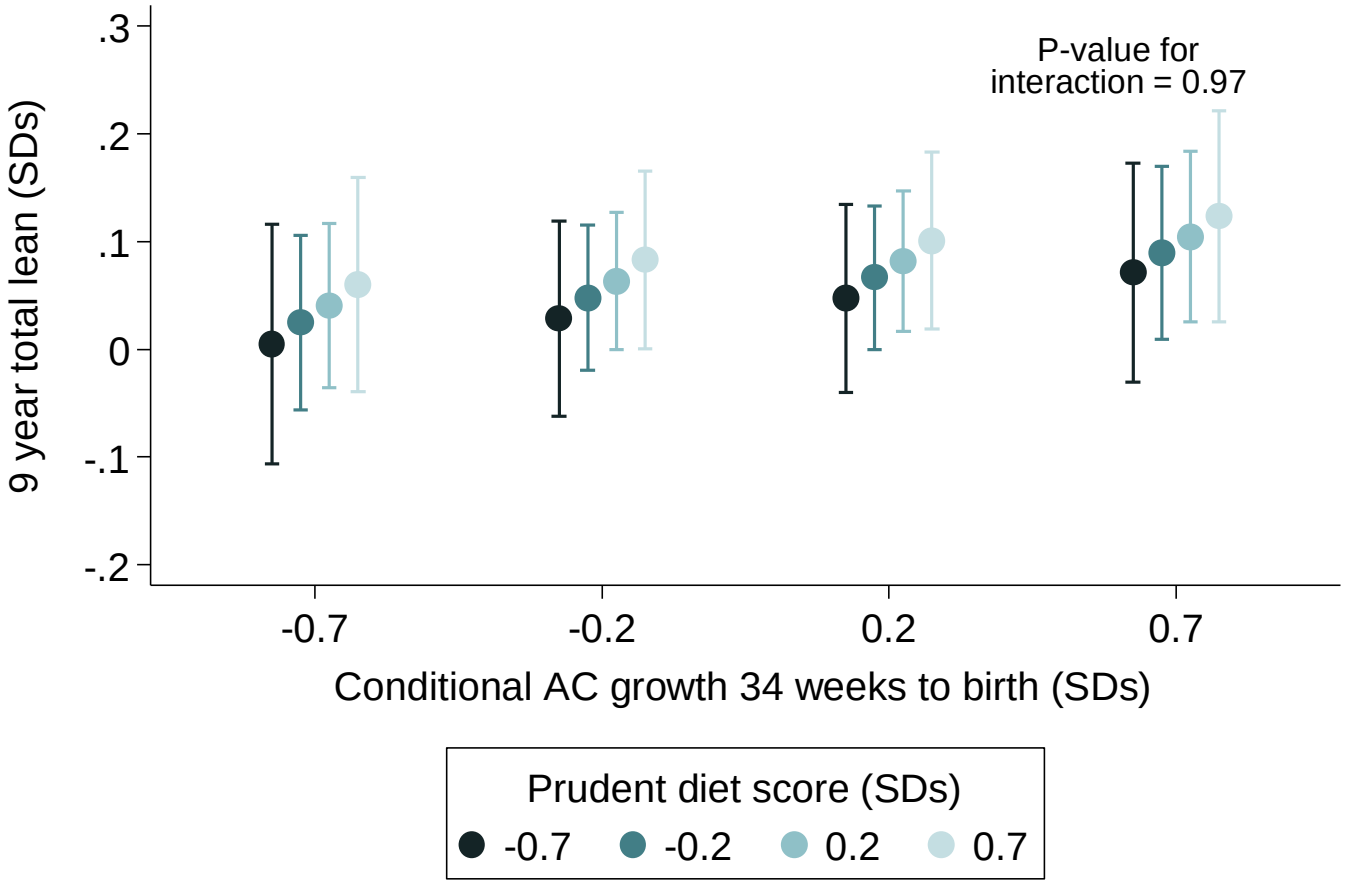
# Interaction – total fat



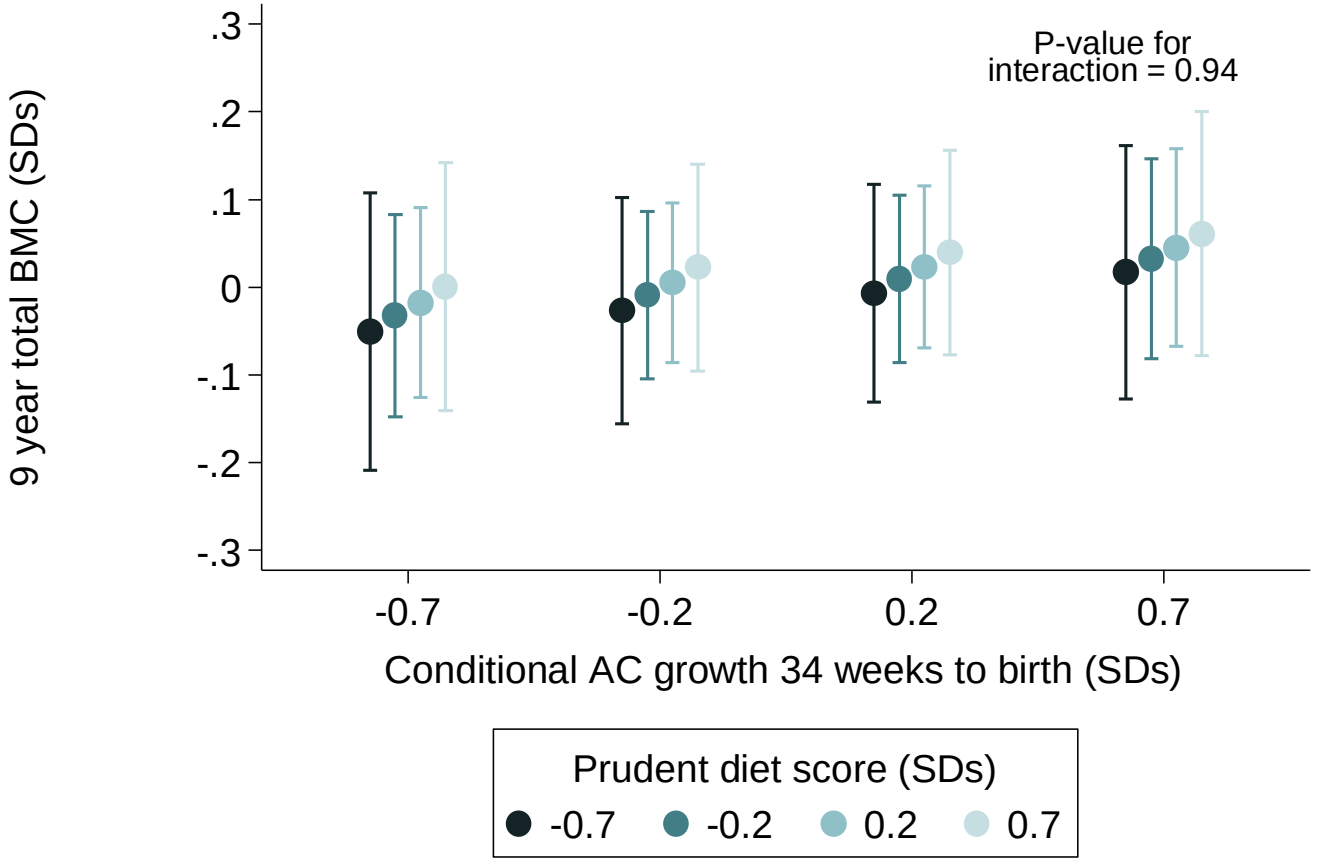
# Interaction – percentage fat



# Interaction – total lean



# Interaction – total BMC



# Strengths and weaknesses

- Strengths

  Detailed anthropometric measurement and conditional growth analyses enabled description of abdominal circumference growth.

  Dietary patterns describe broad patterns of diet, with greater potential for public health intervention.

  Directed acyclic graphs provide an objective method to determine confounders, aiming to describe causality.

- Weakness

  The conditional growth method only provides measures of fetal growth for participants with abdominal circumference data at all time points.

# Conclusions

- Individuals showing late gestation faltering of fetal growth who then had an unhealthy childhood diet had greater adiposity, while childhood diet was less influential on adiposity in individuals whose fetal growth had not faltered.
- There were no similar interactions for lean and BMC outcomes.
- The result for adiposity provides some evidence in support of the mismatch hypothesis.

# Acknowledgements

12,583 SWS study participants

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