

LONDON
SCHOOL of
HYGIENE
& TROPICAL
MEDICINE



Videholm, S; Silfverdal, SA; Reniers, G (2018) Maternal weight and infections in early childhood: a cohort study. *Archives of disease in childhood*. ISSN 0003-9888 DOI: <https://doi.org/10.1136/archdischild-2017-314628>

Downloaded from: <http://researchonline.lshtm.ac.uk/4648296/>

DOI: [10.1136/archdischild-2017-314628](https://doi.org/10.1136/archdischild-2017-314628)

Usage Guidelines

Please refer to usage guidelines at <http://researchonline.lshtm.ac.uk/policies.html> or alternatively contact researchonline@lshtm.ac.uk.

Available under license: <http://creativecommons.org/licenses/by-nc-nd/2.5/>

Archives of
Disease in Childhood

Maternal weight and infections in early childhood: a cohort study

Journal:	<i>Archives of Disease in Childhood</i>
Manuscript ID	archdischild-2017-314628.R1
Article Type:	Original article
Edition:	not in use
Date Submitted by the Author:	14-Apr-2018
Complete List of Authors:	Videholm, Samuel; Umea universitet Institutionen for Klinisk vetenskap, Pediatrics; Osternsunds sjukhus, Unit of Research, Development, and Education Silfverdal, Sven-Arne; Umea universitet Institutionen for Klinisk vetenskap, Pediatrics Reniers, Georges ; London School of Hygiene and Tropical Medicine Faculty of Epidemiology and Population Health; University of the Witwatersrand School of Public Health
Keywords:	Infectious Diseases, Public Health, Obesity, Epidemiology, Comm Child Health

SCHOLARONE™
 Manuscripts

1
2
3 Maternal weight and infections in early childhood: a cohort study
4
5

6 Samuel Videholm^{1,2}, Sven-Arne Silfverdal², Georges Reniers^{3,4}
7

8 ¹Department of Clinical Sciences, Paediatrics, Umeå University, Umeå, Sweden
9

10 ²Unit of Research, Development, and Education, Östersund Hospital, Östersund, Sweden
11

12 ³Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine,
13 London, UK

14 ⁴School of Public Health, University of the Witwatersrand, Johannesburg, South Africa
15
16
17

18 Corresponding author:

19 Name: Samuel Videholm

20 E-mail: vivi0001@student.umu.se
21

22 Telephone number: +46 907858919
23

24 Fax: +46 90123728
25

26 Postal address:
27

28 Department of Clinical Sciences, Paediatrics,
29

30 Umeå University
31

32 901 87 Umeå
33

34 Sweden
35
36

37 Keywords:

38 Infectious Diseases
39

40 Public Health
41

42 Obesity
43

44 Epidemiology
45

46 Community Child Health
47
48

49 Word count: 2484
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Abstract

4
5 Objective: The aim of this study was to examine this association between maternal weight during
6 pregnancy and the incidence of hospitalisations for infectious diseases during early childhood.
7
8

9
10 Design: A population-based cohort study.
11

12
13 Setting: A national cohort was created by combining data from the Swedish Medical Birth Register,
14 the National Inpatient Register, the Cause of Death Register, the Total Population Register and the
15 Longitudinal integration database for health insurance and labour market studies.
16
17

18
19 Patients: 693,007 children born in Sweden between 1998 and 2006.
20

21
22 Main outcome measures: Number of hospitalisations for infectious diseases during the first five years
23 of life, overall and for categories of infectious diseases (lower respiratory, enteric, upper respiratory,
24 genitourinary, perinatal, skin and soft tissue, neurological and eye, digestive tract, bloodstream and
25 other infections).
26
27
28
29

30
31 Results: Overweight (Body Mass Index (BMI) 25.0–29.9) and obesity (BMI \geq 30) during pregnancy
32 were associated with a higher overall incidence of hospitalisations for infectious diseases, adjusted
33 incidence rate ratio (IRR) 1.05 (95% CI 1.03–1.06) and adjusted IRR 1.18 (95% CI 1.16–1.21).
34
35

36
37 Overweight and obesity during pregnancy were strongly associated with perinatal infections,
38 adjusted IRR 1.34 (95% CI 1.25–1.44) and adjusted IRR 1.72 (95% CI 1.57–1.88). In contrast, we found
39 no association between maternal weight during pregnancy and infections of skin and soft tissue, the
40 nervous system, the digestive tract or the bloodstream.
41
42
43
44
45

46
47 Conclusions: We observed an association between overweight and obesity during pregnancy, and
48 hospitalisations for infectious diseases during early childhood.
49
50
51
52
53
54
55
56
57
58
59
60

INTRODUCTION

Excess weight during pregnancy is a global health issue. Overweight (Body Mass Index (BMI) 25.0–29.9) and obesity (BMI \geq 30.0) are increasing among women of reproductive age (20–49 years) in all regions of the world.¹ Furthermore, increasing levels of excess weight during pregnancy have been reported from many countries including UK, Tanzania and Sweden.^{2–4} In Sweden, the prevalence of overweight during pregnancy increased from around 9 % in 1978 to 25,4 % in 2015, whereas the prevalence obesity increased from around 2 % to 13,6 %.^{5,6}

Excess weight during pregnancy is associated with severe consequences for the mother, foetus and child. Obesity during pregnancy increases the risk of e.g. pre-eclampsia, gestational diabetes, infections and pulmonary embolism.^{7–10} Moreover, obesity during pregnancy is associated with increased risks for preterm birth, stillbirth, and congenital malformations of the nervous system and heart.¹⁰ After birth, children of obese mothers have increased risk of asphyxia (low APGAR-score) and death during the neonatal period.^{4,7}

While it is well established that excess weight during pregnancy is associated with many adverse outcomes, less is known about its association with infectious diseases during early childhood.

Previous studies have shown that maternal obesity before the pregnancy is associated with an increased risk for pneumonia during the first 6 months after birth and hospitalisations for infectious diseases during the first 5 years of life.^{11,12} Nevertheless, there is still a scarcity of studies assessing the association between maternal weight before or during pregnancy and infectious diseases in early childhood. Additionally, no previous study systematically examined the associations for different categories of infectious diseases. Therefore, the aim of this study was to examine the association between excess weight during pregnancy and infectious disease incidence, which, in this study is measured by number of hospitalisations for infectious diseases during the first five years of life.

METHODS

Setting

1
2
3 Sweden is a welfare state with a publicly funded healthcare system, free education and a
4 comprehensive social insurance system. Healthcare during childhood and adolescence is provided for
5 free. All children are also offered a standard vaccination program.¹³ The social insurance system
6 includes social assistance, which is an income allowance from social authorities that provides a
7 minimum living standard including housing, food, clothes and health.¹⁴
8
9
10
11
12

13 14 **Study population and data retrieval**

15
16 This is a population-based cohort study of children born in Sweden between 1998 and 2006. The
17 cohort was created by combining several registers held by the National Board of Health and Welfare
18 and by Statistics Sweden. The Medical Birth Register (MBR) contains information on prenatal,
19 delivery and neonatal care (up to 28 days). It covers 98–99 % of all births in Sweden.¹⁵ The cause of
20 death register (CDR) contains information on deaths including a Statistical Classification of Diseases
21 (ICD) code of underlying cause and covers over 97% all deaths.¹⁶ LISA (Longitudinal integration
22 database for health insurance and labour market studies) contains socio-economic data including
23 education level. The Swedish Total Population Register contains information about migration. The
24 National Inpatient Register (NIR) contains information about hospital admissions including ICD code
25 for primary diagnosis and cover over 99% of all inpatient hospital admissions in Sweden.¹⁷ These
26 registers were linked together using the national registration number, a unique personal
27 identification number assigned to all Swedish residents at birth or immigration. The data were linked
28 and anonymized by the Centre for Epidemiology at the Swedish National Board of Health and
29 Welfare. The final cohort included all live births recorded in the MBR during the study period.
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45

46 **Explanatory variables**

47
48 Maternal BMI during pregnancy was calculated from height and weight recorded in MBR. Height was
49 self-reported while weight was measured at the first antenatal care visit, which occurs between 8
50 and 12 weeks of gestation for approximately 90 percent of pregnant women.¹⁵ In comparison with
51 pre-pregnancy weight, weight measured in the first trimester will be slightly higher.¹⁸ Maternal BMI
52
53
54
55
56
57
58
59
60

1
2
3 during pregnancy was categorised, according to WHO guidelines for BMI, into underweight (<18.5),
4 normal (18.5– 24.9), overweight (25.0–29.9) and obese (≥ 30.0).¹⁹

6
7 Data on maternal age, maternal smoking, parity and geographic region was obtained from the MBR.
8
9 Maternal smoking was reported during an interview at the first antenatal care visit, this self-reported
10 data show high agreement with cotinine (a metabolite of nicotine) levels in maternal serum (95 % of
11 self-reported non-smokers have low levels of serum cotinine).²⁰ Parity was recorded as the number
12 of previous live or stillbirths + 1. The region is the county where the mother resided at the time of
13 delivery.
14
15
16
17
18
19

20
21 Socioeconomic status was measured by maternal education and data were obtained from LISA for
22 the year of birth. Maternal education was divided into lower secondary school or less (9 years or
23 less), upper secondary school (10–12 years), short post-secondary education (13–15 years) and long
24 post-secondary education (16 years or more).
25
26
27
28
29

30 **Outcomes**

31
32 The main outcome was number of inpatient hospital admissions with a principal diagnosis of
33 infectious disease recorded in NPR during the first five years of life. Hospital admissions were
34 recorded using International Classification of Disease, Tenth Revision (ICD-10) codes, and mapped
35 onto a modified classification scheme that distinguishes between 10 major infectious disease
36 categories (lower respiratory, enteric, upper respiratory, genitourinary, perinatal, skin and soft
37 tissue, neurological and eye, digestive tract, bloodstream and other infections).²¹ Readmissions on
38 the same day with the same infectious category were excluded. A list of ICD codes is included in
39 Appendix A.
40
41
42
43
44
45
46
47
48
49

50 **Statistical methods**

51
52 Children were followed until 5 years of age or censoring due to death or international migration.
53
54 Incidence rates (IRs) were estimated for overall risk of infectious diseases and for specific subsets of
55
56
57
58
59
60

1
2
3 infectious diseases. The IRs were calculated as number of hospital admissions per 100,000 person-
4
5 years (PY) at risk.
6

7
8 Crude and adjusted associations of the association between pregnancy weight categories (exposure)
9
10 and number of hospitalisations (outcomes) were calculated using negative binomial regression
11
12 models and presented as Incidence Rate Ratios (IRR). The adjusted models were controlled for
13
14 potentially confounding effects of maternal age, maternal education level, maternal smoking, parity,
15
16 geographic region and time trends (year of birth). A separate model was fitted for each outcome
17
18 (overall and categories of infectious diseases). All analyses were restricted to observations with
19
20 complete information on all covariates. Negative binomial models were chosen over Poisson
21
22 regression models, a choice that was informed by a likelihood ratio test for overdispersion.
23
24

25 In sensitivity analysis, we used multiple imputation methods to impute missing data.²² The missing
26
27 data pattern was arbitrary, and we therefore used a chained equations approach. We developed two
28
29 predictive models. Both models included all variables in the adjusted substantive model and the
30
31 outcome (overall number of hospitalisations for infectious diseases). In the first predictive model, we
32
33 first imputed region, then maternal education, maternal smoking and pregnancy BMI. In the second
34
35 predictive model, we reversed the order of imputation. All missing values were imputed using ordinal
36
37 logistic regression. Ten imputed datasets were generated for each predictive model.
38
39

40 All statistical analyses were performed using Stata version 14 (StataCorp. 2015. Stata Statistical
41
42 Software: Release 14. College Station, TX: StataCorp LP).
43
44

45 The study was approved by the Regional Ethics Committee at Umeå University (nr 2012-265-31M and
46
47 2013-320-32M) and by the MSc Research Ethics Committee at London School of Hygiene Tropical
48
49 Medicine (nr 10852).
50

51 52 **RESULTS** 53 54 55 56 57 58 59 60

1
2
3 The MBR contained 838,756 records of live births between 1998 and 2006. Children with missing
4 data on pregnancy BMI (n = 114,588) or covariates (n = 31,161) were excluded from the complete
5 case analyses. We followed all remaining 693,007 children (83 % of the original cohort) until 5 years
6 of age, censoring due to death (n = 2,001) or international migration (n = 9,338). The study included
7 3,432,561 person-years of follow up time. During the follow-up period, 125,297 inpatient hospital
8 admissions for infectious diseases were recorded in NPR. Readmissions on the same day and
9 recorded with the same infectious disease category were excluded (n = 287) leaving 125,010 hospital
10 admissions.

11
12 Table 1 show key background characteristics for the study population. Women with low education
13 level were, in comparison with women with and long post-secondary education, more likely to be
14 overweight or obese during pregnancy. Smoking during pregnancy and parity ≥ 4 were also associated
15 with obesity during pregnancy. In contrast, women who resided in Stockholm (the capital) region
16 were less likely to be obese.

17
18 Table 2 shows Incidence Rates (IR) per 100,000 Person-Years (PY) overall and for categories of
19 infectious diseases, by pregnancy BMI categories. Overall incidence of infectious disease
20 hospitalisations increased considerably with pregnancy BMI, from 3479 per 100,000 PY (95% CI
21 3454–3504) for children of normal weight mothers to 3739 per 100,000 PY (95% CI 3698–3780) for
22 children of overweight mothers and 4341 per 100,000 PY (95% CI 4274–4410) for children of obese
23 mothers. The three most important categories of infectious diseases were lower respiratory, enteric
24 and upper respiratory infections. The largest difference between pregnancy weight categories was
25 observed for perinatal infections.

26
27 Figure 1 shows the association between the BMI during pregnancy and overall number of
28 hospitalisations for infectious diseases during the first five years of life. The incidence rate of hospital
29 admissions for infectious diseases was 5% higher for children whose mothers were overweight
30 during pregnancy (adjusted Incidence Rate Ratio (IRR) 1.05, 95% CI 1.03–1.06). Children of obese
31

1
2
3 mothers were 18% more likely to be admitted (adjusted IRR 1.18, 95% CI 1.16–1.21). Appendix B
4
5 includes full regression results for the analyses presented in Figure 1 as well as results from models
6
7 with multiple imputation for missing values. Results after multiple imputation were consistent with
8
9 those from the complete case analyses.

10
11
12 Figure 2 shows associations between BMI during pregnancy and the number of hospitalisations for
13
14 specific infectious disease categories during the first five years of life. In the adjusted analysis,
15
16 overweight and obesity during pregnancy were associated with upper respiratory infections,
17
18 genitourinary infections, perinatal infections and other infections. In addition, obesity during
19
20 pregnancy was also associated with lower respiratory and enteric infections. In contrast, overweight
21
22 and obesity during pregnancy were not associated with skin and soft tissue infections, neurological
23
24 and eye infections, digestive tract infections and bloodstream infections. The risk of perinatal
25
26 infections was 34% higher among children whose mothers were overweight (adjusted IRR 1.34, 95%
27
28 CI 1.25–1.44) and 72% higher among children to obese mothers (adjusted IRR 1.72, 95% CI 1.57–
29
30 1.88). However, only 3.5 % of the infectious disease-related admissions were due to perinatal
31
32 infections. Appendix C includes full regression results for the analyses presented in Figure 2 as well as
33
34 results from models with multiple imputation for missing values. Results after multiple imputation
35
36 were largely consistent with those from the complete case analyses.

37 38 39 **DISCUSSION**

40
41
42 We found a moderate association between obesity during pregnancy and the overall number of
43
44 hospitalisations for infectious diseases before children's fifth birthday. The association was most
45
46 explicit for respiratory infections, genitourinary infections and perinatal infections. In contrast, the
47
48 association between overweight during pregnancy and hospitalisations for infectious diseases was
49
50 weaker and only noteworthy for perinatal infections.

51
52
53 An association between maternal obesity and the overall risk of hospitalisations for infectious
54
55 diseases was hypothesized since maternal obesity is associated with many detrimental conditions,
56
57
58
59

1
2 including preterm births, low birth weight, birth complications and congenital anomalies.^{10,23} These
3 conditions contribute to a generally increased vulnerability in the offspring including a higher
4 susceptibility to infections. Two previous studies have examined the association between maternal
5 obesity and the overall risk of hospitalisations for infectious diseases. A recent cohort study from
6 Australia including 2807 children reported that children of obese mothers were 2.3 times more likely
7 to be hospitalized for infectious diseases during the first five years of life.¹² Compared to our study,
8 the stronger association may be due to different ICD-codes used to define "infectious diseases". We
9 used ICD codes with an infectious cause from all ICD-10 chapters, whereas the Australian study only
10 used ICD-codes from the first ICD-10 chapter. In a similar setting to ours, a cohort study of 6022
11 Danish children found no association between maternal overweight (BMI greater than or equal to 24
12 kg/m²) and hospitalisations for infectious diseases during early childhood.²⁴ However, an
13 insignificant association (crude IRR 1.11, 95% CI 0.97–1.27) was reported. In comparison to these
14 studies, the large study population in our study yield more precise estimates and allowed us to
15 examine the association between maternal weight and specific infectious disease categories.
16
17 Overweight and obesity during pregnancy were associated with perinatal infections. Additionally,
18 obesity during pregnancy was also associated with respiratory, genitourinary and enteric infections.
19 The strong association between maternal BMI during pregnancy and perinatal infections was
20 anticipated from previous research e.g. both maternal overweight and obesity have been associated
21 with higher infant mortality.⁴ The associations between maternal obesity and both respiratory and
22 enteric infections can, at least in part, be explained by reduced breastfeeding among obese
23 mothers.²⁵ Breastfeeding decreases the risk for several infectious diseases including respiratory and
24 enteric infections.²⁶ The association between maternal obesity and respiratory infections have been
25 examined in two previous large cohort studies. Our results are consistent with findings from a
26 Taiwanese study that reported an increased risk of pneumonia during the first 6 months for children
27 of mothers with a pre-pregnancy BMI of 24 or higher.¹¹ Additionally, a Norwegian study found an
28 association between maternal obesity and lower respiratory infections during the first 18 months.
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 However, this association did not persist in the adjusted analyses.²⁷ In comparison with our study,
4 these analyses were also adjusted for maternal income, maternal marital status, maternal asthma,
5 parental smoking after birth, breastfeeding, and type of daycare. To our knowledge, no previous
6 studies have examined the association between maternal weight during pregnancy and enteric or
7 genitourinary infections during early childhood.
8
9

10
11
12
13
14 Strengths of this study include the large size of the study population, which allowed us to
15 systematically examine the associations between BMI during pregnancy and risk of hospitalisations
16 for categories of infectious diseases; the use of several high-quality registers which allowed analysis
17 to be adjusted for potential confounders including maternal education level. However, our study has
18 several weaknesses. A large number of individuals had missing data on BMI during pregnancy, the
19 main exposure. Therefore, we used multiple imputation to include individuals with missing data.
20 Estimates after multiple imputation were similar to estimates from complete case analyses indicating
21 no major selection bias due to missing data, under the assumption that data were missing at
22 random.²² Another limitation is the lack of information about breastfeeding, childhood obesity and
23 other potential mediators. Therefore, we did not conduct a mediation analysis of the association
24 between maternal weight during pregnancy and hospitalisations for infectious diseases. Finally, there
25 is a risk of residual confounding due to unmeasured or incompletely measured factors including
26 ethnicity and socioeconomic status.
27
28
29
30
31
32
33
34
35
36
37
38
39
40

41
42 In conclusion, this study found an association between overweight and obesity during pregnancy and
43 the overall risk of hospitalisations for infectious diseases in early childhood. Thereby, it contributes to
44 the growing evidence about the wide range of adverse outcomes associated with overweight and the
45 need for stepping up policy interventions.
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Contributors: SV conceptualised and designed the study, performed data analyses and wrote the manuscript. GR contributed to the design, assisted with the statistical analyses and revised the manuscript. SAS created the database contributed to the design and revised the manuscript. All authors approved the final manuscript.

Competing interests: We have no conflict of interest to declare.

Funding This study was supported by a grant from the Oskarsfonden (Box 36, 932 51 Bureå, Sweden.

Epost: info@oskarfonden.se).

Patient consent: Patient informed consent was not needed because the data collected were retrospective and deidentified.

Ethics approval: The study was approved by the Regional Ethics Committee at Umeå University (nr 2012-265-31M and 2013-320-32M) and by the MSc Research Ethics Committee at London School of Hygiene Tropical Medicine (nr 10852). The retrieval and use of register data were also approved through a separate review of data safety and confidentiality by Swedish National Board of Health and Welfare, and by Statistics Sweden.

Data sharing statement: The data used in this study were obtained from third parties. It includes sensitive information and some access restrictions apply to the data. Interested researchers need to obtain data directly from National Board of Health and Welfare in Sweden and from Statistics Sweden. Children included in the study were identified in the Medical Birth Register, data on hospitalisations were obtained from the Swedish National Patient Register and data on deaths were obtained from the Cause of Death Register. All of these registers are maintained by National Board of Health and Welfare in Sweden. Data on maternal education was obtained from the Longitudinal Integration Database for Health Insurance and Labour market Studies and data on migration was obtained from the Swedish Total Population Register, both registers are maintained by Statistics Sweden.

1
2
3 “What is already known on this topic”
4

5 Children of overweight mothers are more likely to have birth complications, congenital anomalies
6
7 and other detrimental conditions.
8
9

10 An increased risk of infectious disease in children of overweight mothers has been observed in some
11
12 smaller cohort studies.
13

14
15 There is no previous large population-based cohort study on the association between overweight
16
17 during pregnancy, and the risk of infectious disease during early childhood.
18

19
20 “What this study adds”
21

22
23 We found an association between overweight and obesity during pregnancy and the overall risk of
24
25 infectious disease hospitalisations during early childhood.
26

27
28 Overweight and obesity during pregnancy were both strongly associated with perinatal infections;
29
30 obesity during pregnancy was also modestly associated with respiratory and genitourinary infections.
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

REFERENCES

- 1 Black RE, Victora CG, Walker SP, *et al.* Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet* 2013;382:427-51.
- 2 Heslehurst N, Ells LJ, Simpson H, Batterham A, Wilkinson J, Summerbell CD. Trends in maternal obesity incidence rates, demographic predictors, and health inequalities in 36,821 women over a 15-year period. *BJOG : an international journal of obstetrics and gynaecology* 2007;114:187-94.
- 3 Villamor E, Msamanga G, Urassa W, *et al.* Trends in obesity, underweight, and wasting among women attending prenatal clinics in urban Tanzania, 1995-2004. *The American journal of clinical nutrition* 2006;83:1387-94.
- 4 Johansson S, Villamor E, Altman M, Bonamy AK, Granath F, Cnattingius S. Maternal overweight and obesity in early pregnancy and risk of infant mortality: a population based cohort study in Sweden. *Bmj* 2014;349:g6572.
- 5 Brynhildsen J, Sydsjo A, Ekholm-Selling K, Josefsson A. The importance of maternal BMI on infant's birth weight in four BMI groups for the period 1978-2001. *Acta obstetrica et gynecologica Scandinavica* 2009;88:391-6.
- 6 Socialstyrelsen. Statistik om graviditeter, förlossningar och nyfödda barn 2015. 2017 Mar. <http://www.socialstyrelsen.se/publikationer2017/2017-3-3> (accessed 10 April 2018).
- 7 Aviram A, Hod M, Yogev Y. Maternal obesity: implications for pregnancy outcome and long-term risks-a link to maternal nutrition. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics* 2011;115 Suppl 1:S6-10.
- 8 Sebire NJ, Jolly M, Harris JP, *et al.* Maternal obesity and pregnancy outcome: a study of 287,213 pregnancies in London. *International journal of obesity and related metabolic disorders : journal of the International Association for the Study of Obesity* 2001;25:1175-82.
- 9 Vasudevan C, Renfrew M, McGuire W. Fetal and perinatal consequences of maternal obesity. *Archives of disease in childhood Fetal and neonatal edition* 2011;96:F378-82.
- 10 Ruager-Martin R, Hyde MJ, Modi N. Maternal obesity and infant outcomes. *Early human development* 2010;86:715-22.
- 11 Chen CH, Wen HJ, Chen PC, *et al.* Prenatal and postnatal risk factors for infantile pneumonia in a representative birth cohort. *Epidemiology and infection* 2012;140:1277-85.
- 12 Cameron CM, Shibl R, McClure RJ, Ng SK, Hills AP. Maternal pregravid body mass index and child hospital admissions in the first 5 years of life: results from an Australian birth cohort. *International journal of obesity* 2014;38:1268-74.
- 13 Anell A, Glenngard AH, Merkur S. Sweden health system review. *Health systems in transition* 2012;14:1-159.
- 14 Weitoft GR, Hjern A, Batljan I, Vinnerljung B. Health and social outcomes among children in low-income families and families receiving social assistance - A Swedish national cohort study. *Social science & medicine* 2008;66:14-30.
- 15 Socialstyrelsen. The Swedish Medical Birth Register - A summary of content and quality. 2003 Nov. http://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/10655/2003-112-3_20031123.pdf (accessed 10 April 2018).
- 16 Socialstyrelsen. Causes of Death 2014. 2015 Aug. <http://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/19909/2015-8-1.pdf> (accessed 10 April 2018).
- 17 Ludvigsson JF, Andersson E, Ekblom A, *et al.* External review and validation of the Swedish national inpatient register. *BMC public health* 2011;11:450.
- 18 Margerison-Zilko CE, Shrimali BP, Eskenazi B, Lahiff M, Lindquist AR, Abrams BF. Trimester of maternal gestational weight gain and offspring body weight at birth and age five. *Maternal and child health journal* 2012;16:1215-23.

- 1
2
3 19 World Health Organization. Global database on body mass index: BMI classification.
4 http://apps.who.int/bmi/index.jsp?introPage=intro_3.html (accessed 10 April 2018).
5 20 Mattsson K, Kallen K, Rignell-Hydbom A, *et al.* Cotinine Validation of Self-Reported Smoking
6 During Pregnancy in the Swedish Medical Birth Register. *Nicotine & tobacco research : official journal*
7 *of the Society for Research on Nicotine and Tobacco* 2016;18:79-83.
8 21 Baker MG, Barnard LT, Kvalsvig A, *et al.* Increasing incidence of serious infectious diseases and
9 inequalities in New Zealand: a national epidemiological study. *Lancet* 2012;379:1112-9.
10 22 Sterne JA, White IR, Carlin JB, *et al.* Multiple imputation for missing data in epidemiological and
11 clinical research: potential and pitfalls. *Bmj* 2009;338:b2393.
12 23 Stothard KJ, Tennant PW, Bell R, Rankin J. Maternal overweight and obesity and the risk of
13 congenital anomalies: a systematic review and meta-analysis. *Jama* 2009;301:636-50.
14 24 Yuan W, Basso O, Sorensen HT, Olsen J. Maternal prenatal lifestyle factors and infectious disease
15 in early childhood: a follow-up study of hospitalization within a Danish birth cohort. *Pediatrics*
16 2001;107:357-62.
17 25 Turcksin R, Bel S, Galjaard S, Devlieger R. Maternal obesity and breastfeeding intention, initiation,
18 intensity and duration: a systematic review. *Maternal & child nutrition* 2014;10:166-83.
19 26 Duijts L, Jaddoe VW, Hofman A, Moll HA. Prolonged and exclusive breastfeeding reduces the risk
20 of infectious diseases in infancy. *Pediatrics* 2010;126:e18-25.
21 27 Haberg SE, Stigum H, London SJ, Nystad W, Nafstad P. Maternal obesity in pregnancy and
22 respiratory health in early childhood. *Paediatric and perinatal epidemiology* 2009;23:352-62.
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1: Study population characteristics and their association with pregnancy BMI categories, Sweden (1998–2006)

	Underweight n = 16,241	Normal n = 431,708	Included Overweight n= 171,826	Obese n = 73,232	All n = 693,007	Excluded* All n = 145,749
Maternal age (n (%))						
≤19	765 (7,7)	6462 (64,9)	1910 (19,2)	821 (8,2)	9958	4588
20-24	3905 (4,5)	52815 (61,0)	20263 (23,4)	9662 (11,2)	86645	20519
25-29	5619 (2,5)	141631 (63,1)	53897 (24,0)	23473 (10,5)	224620	42215
30-34	4338 (1,8)	155494 (63,5)	60400 (24,7)	24479 (10,0)	244711	49459
≥35	1614 (1,3)	75306 (59,3)	35356 (27,8)	14797 (11,6)	127073	28968
Parity (n (%))						
1	8525 (2,8)	198523 (66,3)	66458 (22,2)	25863 (8,6)	299369	63728
2	5645 (2,2)	158028 (62,1)	64141 (25,2)	26730 (10,5)	254544	50554
3	1525 (1,6)	56250 (57,6)	27431 (28,1)	12435 (12,7)	97641	20331
≥4	546 (1,3)	18907 (45,6)	13796 (33,3)	8204 (19,8)	41453	11112
Maternal smoking (n (%))						
No smoking	13938 (2,2)	393659 (63,2)	153046 (24,6)	62568 (10,0)	623211	80210
Smoking	2303 (3,3)	38049 (54,5)	18780 (26,9)	10664 (15,3)	69796	10596
Maternal education (n (%))†						
≤9	3151 (3,9)	43753 (53,9)	21784 (26,9)	12413 (15,3)	81101	16222
10-12	7509 (2,2)	194203 (58,1)	89794 (26,9)	42662 (12,8)	334168	55751
13-15	1985 (1,9)	67628 (66,1)	24431 (23,9)	8235 (8,1)	102279	19563
≥16	3596 (2,0)	126124 (71,9)	35817 (20,4)	9922 (5,7)	175459	33978
Region (n (%))						
Blekinge	239 (2,0)	7160 (60,1)	3107 (26,1)	1411 (11,8)	11917	1114
Dalarna	389 (2,0)	11262 (56,8)	5516 (27,8)	2677 (13,5)	19844	2512
Gotland	80 (2,0)	2336 (58,4)	1075 (26,9)	512 (12,8)	4003	491
Gävleborg	403 (2,1)	10594 (55,7)	5377 (28,3)	2636 (13,9)	19010	3633
Halland	552 (2,4)	14699 (63,8)	5596 (24,3)	2183 (9,5)	23030	2915
Jämtland	175 (2,0)	5320 (60,3)	2297 (26,0)	1029 (11,7)	8821	1750
Jönköping	622 (2,2)	17071 (60,3)	7486 (26,5)	3122 (11,0)	28301	2615

1						
2						
3						
4						
5	Kalmar	404 (2,5)	9716 (59,1)	4338 (26,4)	1984 (12,1)	16442 1850
6	Kronoberg	308 (2,1)	8954 (60,9)	3745 (25,5)	1689 (11,5)	14696 1091
7	Norrbottn	357 (2,1)	9935 (57,1)	4757 (27,3)	2348 (13,5)	17397 3710
8	Skåne	2252 (2,5)	56244 (61,6)	22835 (25,0)	9940 (10,9)	91271 14878
9	Stockholm	4255 (2,8)	103766 (68,1)	32788 (21,5)	11668 (7,7)	152477 50477
10	Södermanland	439 (2,3)	11021 (57,6)	5244 (27,4)	2421 (12,7)	19125 3417
11	Uppsala	530 (2,2)	15045 (62,1)	6051 (25,0)	2613 (10,8)	24239 5201
12	Värmland	373 (2,0)	11182 (59,0)	5023 (26,5)	2381 (12,6)	18959 3110
13	Västerbotten	366 (2,0)	11023 (61,1)	4667 (25,9)	1984 (11,0)	18040 4134
14	Västernorrland	277 (1,8)	8423 (55,1)	4344 (28,4)	2236 (14,6)	15280 5272
15	Västmanland	453 (2,3)	11733 (59,8)	4994 (25,5)	2430 (12,4)	19610 2536
16	Västra Götaland	2592 (2,2)	73663 (63,0)	28856 (24,7)	11734 (10,0)	116845 27143
17	Örebro	442 (2,3)	11599 (60,2)	4931 (25,6)	2299 (11,9)	19271 4941
18	Östergötland	733 (2,1)	20962 (60,9)	8799 (25,6)	3935 (11,4)	34429 2836
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						

*Children with missing data on pregnancy BMI (n = 114,588) or covariates (n = 31,161) were excluded (totally 17% of the original cohort). Data on covariates were available in 62%–100% of the excluded children.

†Maternal education level at year of birth, categorised into 9 years or less (lower secondary school or less) 10-12 years (upper secondary school) 13-15 years (short post-secondary education) or 16 years or more (long post-secondary education).

Pregnancy BMI categorised as underweight (BMI <18.5), normal (BMI 18.5– 24.9), overweight (BMI 25.0–29.9) and obese (BMI ≥30.0).

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table 2: Inpatient hospital admission rates for overall and for categories of infectious diseases, by pregnancy BMI categories.

Infections	Underweight		Normal		Overweight		Obese	
	Events	IR (95% CI)	Events	IR (95% CI)	Events	IR (95% CI)	Events	IR (95% CI)
All*	3042	3789 (3657 - 3926)	74371	3479 (3454 - 3504)	31847	3739 (3698 - 3780)	15750	4341 (4274 - 4410)
Lower respiratory tract	748	932 (867 - 1001)	19419	908 (896 - 921)	8337	979 (958 - 1000)	4266	1176 (1141 - 1212)
Enteric	846	1054 (985 - 1127)	17638	825 (813 - 837)	7063	829 (810 - 849)	3481	959 (928 - 992)
Upper respiratory tract	576	717 (661 - 778)	15041	704 (692 - 715)	6721	789 (770 - 808)	3271	902 (871 - 933)
Genitourinary	218	272 (238 - 310)	5091	238 (232 - 245)	2265	266 (255 - 277)	1102	304 (286 - 322)
Perinatal†	76	6113 (4882 - 7654)	2411	7295 (7010 - 7592)	1254	9536 (9023 - 10079)	665	11876 (11007 - 12814)
Skin and soft tissue	72	90 (71 - 113)	2135	100 (96 - 104)	825	97 (90 - 104)	396	109 (99 - 120)
Neurological and eye	38	47 (34 - 65)	1121	52 (49 - 56)	403	47 (43 - 52)	182	50 (43 - 58)
Digestive tract	46	57 (43 - 76)	922	43 (40 - 46)	362	43 (38 - 47)	162	45 (38 - 52)
Blood stream	21	26 (17 - 40)	628	29 (27 - 32)	285	33 (30 - 38)	105	29 (24 - 35)
Other	399	497 (451 - 548)	9890	463 (454 - 472)	4299	505 (490 - 520)	2106	580 (556 - 606)

*Includes all perinatal infections.

†Includes only perinatal infections recorded between birth and day 28.

Incidence rates (IRs) estimated as number of inpatient hospital admissions per 100,000 person-years (PY) at risk. Pregnancy BMI categorised as underweight (BMI <18.5), normal (BMI 18.5– 24.9), overweight (BMI 25.0–29.9) and obese (BMI ≥30.0).

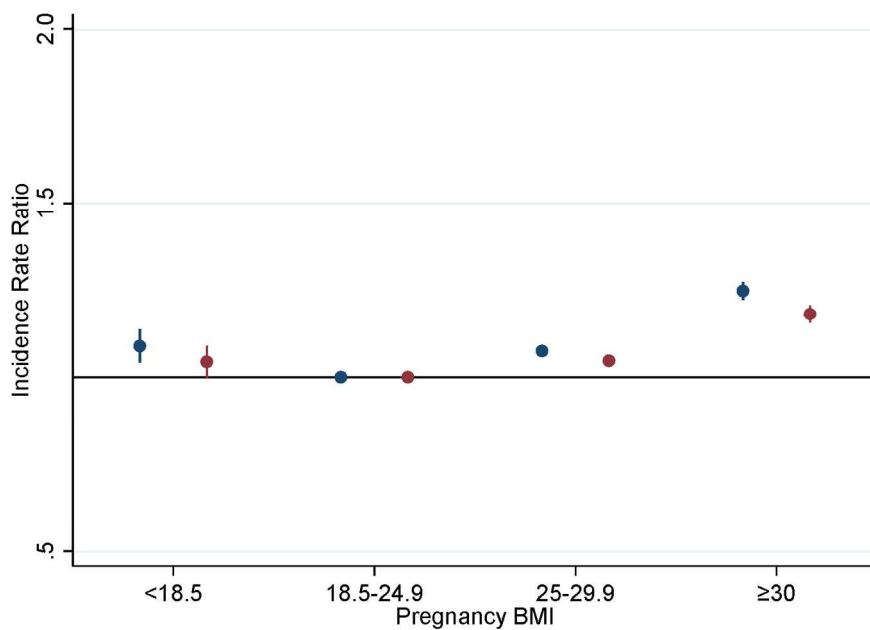


Figure 1: Crude (blue) and adjusted (red) analyses of the association between pregnancy BMI categories and overall risk of infectious disease hospitalisations. Incidence rate ratios were estimated using binomial regression models. Vertical lines represent 95% CIs around the point estimates. Adjusted analyses were adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth. All analyses excluded children with missing data, leaving 693,007 children.

381x319mm (120 x 120 DPI)

View Only

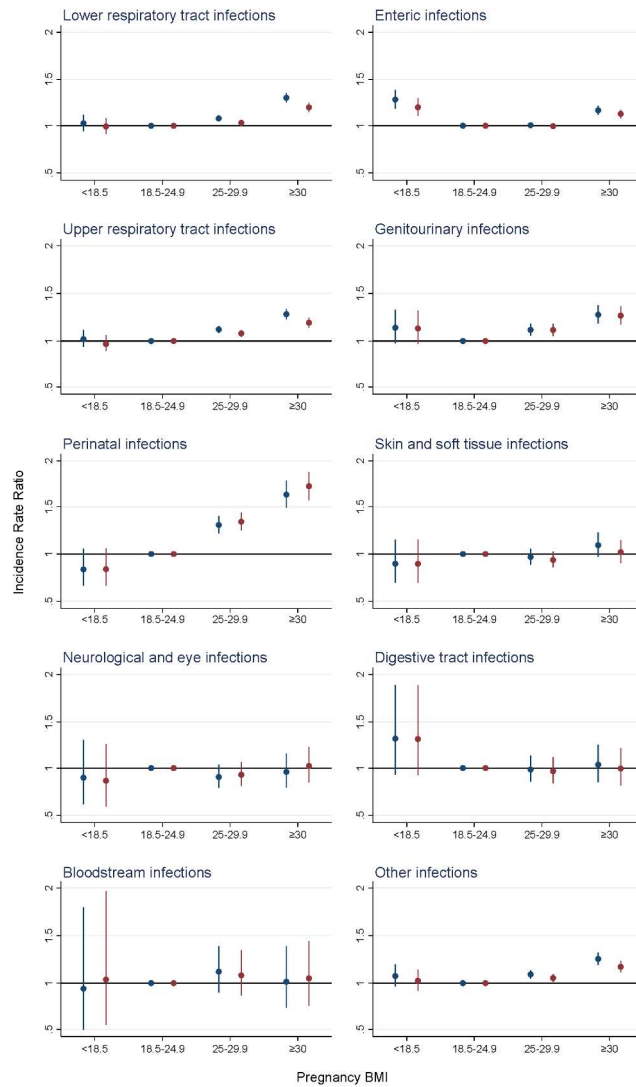


Figure 2: Crude (blue) and adjusted (red) analyses of the association between pregnancy BMI and categories infectious diseases hospitalisations. Incidence rate ratios were estimated using binomial regression models. Vertical lines represent 95% CIs around the point estimates. Adjusted analyses were adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth. All analyses excluded children with missing data, leaving 693,007 children.

165x271mm (300 x 300 DPI)

1
2
3 **Appendix A**
4

5 **Table A: Infectious disease categories and groups**
6

7 Category	8 Group
9 Enteric infections	Enteric infections
	Enteric symptoms
10 Bloodstream infections	Septicemia
11 Neurological & eye infections	Meningococcal disease
	CNS viral infections
	CNS general infections
	Eye infections
16 Upper respiratory tract infections	Ear infections
	Upper RTI
19 Lower respiratory tract infections	Tuberculosis
	Acute LRTI
	Chronic LRTI
22 Digestive tract infections	Oral infections
	Gastrointestinal tract infections
	Hepatic infections
	Viral Hepatitis
27 Genitourinary infections	Kidney infections
	Urinary tract infections
	Reproductive system infections, male
	Reproductive system infections, female
32 Skin & soft tissue infections	Skin infections, typical
	Skin infections, other
	Connective tissue infections
36 Infections of perinatal period	Perinatal infections
37 Other infections	STI
	HIV/AIDS
	Breast infections
	Osteomyelitis
	Joint infections
	Connective tissue infections
	Neoplasms from infection
	Postoperative infections
	Adverse effect of ID treatment
	Other Bacterial Infections
	Other Viral infections
	Other Mycoses
	Other Protozoan infections
	Other ID

Table B: Infectious disease groups and associated ICD codes

ID Group	ICD-10 Codes
Enteric infections	A00, A01, A02, A03, A04, A05, A06, A07, A08
Enteric symptoms	A09, I880, K528, K529, R11
Septicemia	A40, A41
HIV/AIDS	B20, B21, B22, B23, B24
STI	A50, A51, A52, A53, A54, A55, A56, A57, A58, A59, A60, A63, A64, N290
Meningococcal disease	A39
CNS viral infections	A801, A802, A803, A804, A809, A811, A812, A818, A819, A82, A83, A84, A85, A86, A87, A88, A89
CNS general infections	G00, G01, G02, G030, G039, G04, G05, G06, G07, G08, G09, G610
Eye infections	B30, H000, H03, H043, H050, H100, H102, H103, H109, H130, H131, H160, H190, H191, H192, H220, H440, H451
Ear infections	H600, H601, H602, H603, H608, H609, H62, H65, H66, H67, H680, H70, H730, H750, H830, H940
Upper RTI	J00, J01, J02, J03, J04, J05, J06, J32, J340, J36, J37, J390, J391
Tuberculosis	A15, A16, A17, A18, A19, N740, N741, J65
Acute LRTI	A481, A482, B59, J09, J10, J11, J12, J13, J14, J15, J16, J17, J18, J20, J21, J22
Chronic LRTI	J40, J41, J42, J440, J47, J85, J86, J988
Heart & Circulatory infections	B332, I00, I01, I02, I05, I06, I07, I08, I09, I301, I33, I38, I39, I400, I410, I411, I412, I430, I716, I790, I791
Oral infections	K02, K044, K046, K050, K052, K053, K113, K122
Gastrointestinal tract infections	K230, K231, K25, K26, K27, K28, K293, K294, K295, K35, K36, K37, K61, K630, K632, K650, K678, K908, K930
Hepatic infections	K750, K770, K830
Viral Hepatitis	B15, B16, B17, B18, B19
Kidney infections	N00, N05, N10, N136, N151
Urinary tract infections	N300, N341, N351, N37, N390
Reproductive system infections, male	N410, N411, N412, N413, N431, N45, N410, N411, N412, N413, N431, N45, N481, N482, N490, N49, N51
Reproductive system infections, female	N70, N71, N72, N73, N74, N751, N764, N87

1		
2		
3	Skin infections, typical	A46, L00, L01, L02, L03, L04, L050, L08
4		
5		
6	Skin infections, other	B86, T009, T633, T634, T793
7		
8		
9	Breast infections	N61
10		
11	Osteomyelitis	M462, M463, M464, M465
12		
13	Joint infections	M00, M01
14		
15	Connective tissue infections	M021, M023, M03, M600, M630, M631, M632, M650, M651, M680, M710, M711, M896
16		
17	Neoplasms from infection	C11, C161, C162, C163, C164, C165, C166, C168, C169, C210, C211, C220, C46, C53, D002, D013, D06
18		
19	Postoperative infections	T802, T814, T826, T827, T835, T836, T845, T846, T847, T857, T874
20		
21	Adverse effect of ID treatment	R761, R762, T36, T37, T485, T487, T490, T495, T496, T499, T788, T789, T880, T881, T887
22		
23	Other Bacterial infections	A20, A21, A22, A23, A24, A25, A26, A27, A28, A30, A31, A32, A33, A34, A35, A36, A37, A38, A42, A43, A44, A480, A483, A484, A488, A49, A65, A66, A67, A68, A69, A70, A71, A74, A75, A77, A78, A79, B95, B96
24		
25	Other Viral infections	A90, A91, A92, A93, A94, A95, A96, A98, A99, B00, B01, B02, B03, B04, B05, B06, B07, A08, B09, B25, B26, B27, B33, B34, B97
26		
27	Other Mycoses	B35, B36, B37, B38, B39, B40, B41, B42, B43, B44, B45, B46, B47, B48, B49
28		
29	Other Protozoan infections	B50, B51, B52, B53, B54, B55, B56, B57, B58, B60, B64
30		
31	Other ID	B65, B66, B67, B68, B69, B70, B71, B72, B73, B74, B75, B76, B77, B78, B79, B80, B81, B82, B83, B85, B86, B87, B88, B89, B94, B99, E033, E321, F024, F071, I88, T64
32		
33	Perinatal infections	P002, P027, P23, P35, P36, P37, P38, P39
34		
35		
36		
37		
38		
39		
40		
41		
42		
43		
44		
45		
46		
47		
48		
49		
50		
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

Appendix B: Regression outputs for all infections

Table C: All infections

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	1.09	(1.04 - 1.14)	1.04	(1.00 - 1.09)	1.05	(1.00 - 1.09)	1.05	(1.00 - 1.10)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	1.07	(1.06 - 1.09)	1.05	(1.03 - 1.06)	1.05	(1.03 - 1.06)	1.05	(1.04 - 1.07)
	Obese	1.25	(1.22 - 1.28)	1.18	(1.16 - 1.21)	1.19	(1.16 - 1.21)	1.19	(1.16 - 1.21)
Maternal age	≤19			1.02	(0.97 - 1.08)	1.03	(0.98 - 1.07)	1.03	(0.98 - 1.07)
	20-24			1	ref	1	ref	1	ref
	25-29			0.94	(0.92 - 0.96)	0.93	(0.91 - 0.94)	0.93	(0.91 - 0.94)
	30-34			0.88	(0.86 - 0.90)	0.87	(0.85 - 0.89)	0.87	(0.85 - 0.89)
	≥35			0.82	(0.80 - 0.85)	0.82	(0.80 - 0.84)	0.82	(0.80 - 0.84)
Parity	1			1	ref	1	ref	1	ref
	2			1.14	(1.12 - 1.16)	1.14	(1.12 - 1.15)	1.14	(1.12 - 1.15)
	3			1.13	(1.11 - 1.16)	1.15	(1.12 - 1.17)	1.15	(1.12 - 1.17)
	≥4			1.28	(1.24 - 1.32)	1.30	(1.27 - 1.34)	1.30	(1.27 - 1.34)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			1.09	(1.06 - 1.11)	1.08	(1.06 - 1.11)	1.08	(1.06 - 1.11)
Maternal education	≤9			1.19	(1.16 - 1.22)	1.20	(1.17 - 1.23)	1.20	(1.17 - 1.23)
	10-12			1.03	(1.01 - 1.05)	1.04	(1.02 - 1.06)	1.04	(1.02 - 1.06)
	13-14			1	ref	1	ref	1	ref
	≥16			0.97	(0.95 - 0.99)	0.96	(0.94 - 0.98)	0.96	(0.94 - 0.98)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			1.08	(1.02 - 1.15)	1.10	(1.04 - 1.17)	1.10	(1.04 - 1.17)
	Gotland			1.20	(1.10 - 1.32)	1.20	(1.10 - 1.31)	1.20	(1.10 - 1.31)
	Gävleborg			0.78	(0.73 - 0.83)	0.78	(0.73 - 0.83)	0.78	(0.73 - 0.83)
	Halland			1.09	(1.02 - 1.15)	1.09	(1.03 - 1.16)	1.09	(1.03 - 1.16)
	Jämtland			1.25	(1.17 - 1.35)	1.26	(1.18 - 1.34)	1.26	(1.18 - 1.34)
	Jönköping			0.67	(0.63 - 0.71)	0.67	(0.63 - 0.71)	0.67	(0.63 - 0.71)
Kalmar			1.13	(1.06 - 1.21)	1.14	(1.07 - 1.21)	1.14	(1.07 - 1.21)	

1								
2								
3		Kronoberg	0.72	(0.68 - 0.78)	0.73	(0.68 - 0.78)	0.73	(0.68 - 0.78)
4		Norrbottn	0.99	(0.93 - 1.06)	1.00	(0.94 - 1.06)	1.00	(0.94 - 1.06)
5		Skåne	0.96	(0.91 - 1.01)	0.97	(0.93 - 1.02)	0.97	(0.93 - 1.02)
6		Stockholm	0.82	(0.78 - 0.86)	0.82	(0.78 - 0.86)	0.82	(0.78 - 0.86)
7		Södermanland	0.96	(0.91 - 1.03)	0.97	(0.91 - 1.02)	0.97	(0.91 - 1.02)
8		Uppsala	0.67	(0.63 - 0.72)	0.68	(0.64 - 0.72)	0.68	(0.64 - 0.72)
9		Värmland	0.76	(0.71 - 0.81)	0.76	(0.72 - 0.81)	0.76	(0.72 - 0.81)
10		Västerbotten	1.08	(1.01 - 1.14)	1.07	(1.01 - 1.13)	1.07	(1.01 - 1.13)
11		Västernorrland	1.03	(0.97 - 1.10)	1.04	(0.98 - 1.10)	1.04	(0.98 - 1.10)
12		Västmanland	0.97	(0.91 - 1.03)	0.96	(0.91 - 1.02)	0.96	(0.91 - 1.02)
13		Västra						
14		Götaland	1.02	(0.97 - 1.07)	1.02	(0.97 - 1.07)	1.02	(0.97 - 1.07)
15		Örebro	0.95	(0.89 - 1.01)	0.96	(0.90 - 1.01)	0.96	(0.90 - 1.01)
16		Östergötland	0.70	(0.66 - 0.75)	0.71	(0.67 - 0.75)	0.71	(0.67 - 0.75)
17	Year	1998	1	ref	1	ref	1	ref
18		1999	0.98	(0.95 - 1.01)	0.99	(0.97 - 1.02)	0.99	(0.97 - 1.02)
19		2000	0.94	(0.92 - 0.97)	0.94	(0.92 - 0.97)	0.94	(0.92 - 0.97)
20		2001	0.94	(0.91 - 0.96)	0.94	(0.91 - 0.94)	0.94	(0.91 - 0.94)
21		2002	0.92	(0.89 - 0.95)	0.92	(0.92 - 0.97)	0.92	(0.92 - 0.97)
22		2003	0.93	(0.91 - 0.96)	0.94	(0.90 - 0.94)	0.94	(0.90 - 0.94)
23		2004	0.89	(0.87 - 0.92)	0.90	(0.91 - 0.96)	0.90	(0.91 - 0.96)
24		2005	1.01	(0.98 - 1.04)	1.01	(0.88 - 0.92)	1.01	(0.88 - 0.92)
25		2006	0.94	(0.92 - 0.97)	0.96	(0.99 - 1.04)	0.96	(0.99 - 1.04)
26	Observations (N)	693,007	693,007		838,756		838,756	

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Appendix C: Regression outputs for categories of infectious diseases

Table D: Lower respiratory tract infections

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	1.03	(0.94 - 1.12)	0.99	(0.91 - 1.08)	1.00	(0.92 - 1.08)	1.02	(0.93 - 1.11)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	1.08	(1.05 - 1.11)	1.03	(1.00 - 1.06)	1.03	(1.00 - 1.06)	1.04	(1.01 - 1.07)
	Obese	1.30	(1.25 - 1.35)	1.19	(1.15 - 1.24)	1.20	(1.15 - 1.24)	1.20	(1.15 - 1.25)
Maternal age	≤19			1.14	(1.02 - 1.27)	1.14	(1.05 - 1.25)	1.14	(1.05 - 1.25)
	20-24			1	ref	1	ref	1	ref
	25-29			0.93	(0.89 - 0.97)	0.91	(0.88 - 0.94)	0.91	(0.87 - 0.94)
	30-34			0.84	(0.81 - 0.88)	0.84	(0.81 - 0.87)	0.84	(0.81 - 0.87)
	≥35			0.75	(0.72 - 0.79)	0.75	(0.72 - 0.79)	0.75	(0.72 - 0.78)
Parity	1			1	ref	1	ref	1	ref
	2			1.64	(1.59 - 1.69)	1.61	(1.57 - 1.66)	1.61	(1.57 - 1.66)
	3			1.65	(1.58 - 1.72)	1.66	(1.60 - 1.72)	1.66	(1.60 - 1.72)
	≥4			2.06	(1.96 - 2.18)	2.04	(1.94 - 2.14)	2.04	(1.94 - 2.14)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			1.29	(1.24 - 1.34)	1.26	(1.21 - 1.30)	1.26	(1.21 - 1.30)
Maternal education	≤9			1.09	(1.03 - 1.14)	1.10	(1.05 - 1.16)	1.10	(1.05 - 1.16)
	10-12			1.00	(0.96 - 1.04)	1.01	(0.97 - 1.04)	1.01	(0.97 - 1.05)
	13-14			1	ref	1	ref	1	ref
	≥16			1.01	(0.97 - 1.06)	0.99	(0.96 - 1.03)	1.00	(0.96 - 1.04)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			0.85	(0.76 - 0.95)	0.87	(0.79 - 0.97)	0.87	(0.78 - 0.97)
	Gotland			0.70	(0.58 - 0.85)	0.71	(0.60 - 0.86)	0.71	(0.59 - 0.85)
	Gävleborg			0.60	(0.53 - 0.67)	0.61	(0.55 - 0.69)	0.61	(0.55 - 0.69)
	Halland			1.04	(0.93 - 1.15)	1.08	(0.97 - 1.19)	1.08	(0.97 - 1.19)
	Jämtland			1.07	(0.94 - 1.22)	1.06	(0.94 - 1.20)	1.07	(0.94 - 1.21)
	Jönköping			0.46	(0.41 - 0.52)	0.47	(0.42 - 0.53)	0.47	(0.42 - 0.53)
	Kalmar			1.09	(0.97 - 1.21)	1.14	(1.02 - 1.27)	1.14	(1.02 - 1.27)

1								
2								
3								
4								
5		Kronoberg	0.78	(0.69 - 0.88)	0.81	(0.72 - 0.91)	0.81	(0.72 - 0.91)
6		Norrbottn	0.82	(0.73 - 0.92)	0.87	(0.78 - 0.97)	0.87	(0.78 - 0.97)
7		Skåne	1.02	(0.93 - 1.12)	1.08	(0.99 - 1.18)	1.08	(0.98 - 1.17)
8		Stockholm	0.84	(0.76 - 0.92)	0.88	(0.81 - 0.96)	0.88	(0.81 - 0.96)
9		Södermanland	0.89	(0.80 - 0.99)	0.91	(0.82 - 1.01)	0.91	(0.82 - 1.01)
10		Uppsala	0.42	(0.37 - 0.48)	0.44	(0.39 - 0.49)	0.44	(0.39 - 0.49)
11		Värmland	0.55	(0.48 - 0.62)	0.57	(0.50 - 0.64)	0.57	(0.50 - 0.63)
12		Västerbotten	0.88	(0.78 - 0.98)	0.89	(0.80 - 0.99)	0.89	(0.80 - 0.99)
13		Västernorrland	0.83	(0.74 - 0.93)	0.83	(0.75 - 0.93)	0.83	(0.75 - 0.93)
14		Västmanland	0.88	(0.78 - 0.98)	0.89	(0.80 - 0.99)	0.89	(0.80 - 0.99)
15		Västra						
16		Götaland	0.79	(0.72 - 0.86)	0.81	(0.74 - 0.88)	0.80	(0.74 - 0.88)
17		Örebro	0.80	(0.71 - 0.89)	0.81	(0.73 - 0.90)	0.81	(0.73 - 0.90)
18		Östergötland	0.56	(0.50 - 0.62)	0.58	(0.52 - 0.64)	0.58	(0.52 - 0.64)
19		Year						
20		1998	1	ref	1	ref	1	ref
21		1999	1.17	(1.11 - 1.24)	1.19	(1.13 - 1.25)	1.19	(1.13 - 1.25)
22		2000	1.08	(1.02 - 1.15)	1.08	(1.02 - 1.14)	1.08	(1.02 - 1.14)
23		2001	1.29	(1.22 - 1.37)	1.30	(0.88 - 0.94)	1.30	(0.87 - 0.94)
24		2002	1.15	(1.09 - 1.21)	1.14	(1.23 - 1.36)	1.14	(1.23 - 1.36)
25		2003	1.21	(1.14 - 1.28)	1.21	(1.09 - 1.20)	1.21	(1.08 - 1.20)
26		2004	1.15	(1.09 - 1.22)	1.15	(1.15 - 1.27)	1.15	(1.15 - 1.27)
27		2005	1.61	(1.52 - 1.70)	1.59	(1.10 - 1.21)	1.59	(1.09 - 1.21)
28		2006	1.23	(1.16 - 1.30)	1.24	(1.51 - 1.67)	1.24	(1.51 - 1.67)
29		Observations (N)	693,007	693,007	838,756	838,756	838,756	838,756

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table E: Enteric infection

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	1.28	(1.18 - 1.38)	1.20	(1.11 - 1.29)	1.17	(1.09 - 1.26)	1.18	(1.10 - 1.27)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	1.00	(0.98 - 1.04)	1.00	(0.97 - 1.03)	1.00	(0.98 - 1.03)	1.01	(0.98 - 1.04)
	Obese	1.16	(1.12 - 1.21)	1.12	(1.08 - 1.17)	1.14	(1.10 - 1.19)	1.14	(1.10 - 1.19)
Maternal age	≤19			0.93	(0.84 - 1.02)	0.91	(0.83 - 0.99)	0.91	(0.84 - 0.99)
	20-24			1	ref	1	ref	1	ref
	25-29			0.93	(0.90 - 0.97)	0.93	(0.90 - 0.97)	0.93	(0.90 - 0.97)
	30-34			0.87	(0.83 - 0.91)	0.85	(0.82 - 0.89)	0.85	(0.82 - 0.89)
	≥35			0.80	(0.76 - 0.84)	0.80	(0.77 - 0.84)	0.80	(0.77 - 0.84)
Parity	1			1	ref	1	ref	1	ref
	2			0.88	(0.85 - 0.90)	0.88	(0.86 - 0.90)	0.88	(0.86 - 0.90)
	3			0.86	(0.82 - 0.89)	0.88	(0.85 - 0.91)	0.88	(0.85 - 0.91)
	≥4			0.95	(0.90 - 1.01)	0.99	(0.94 - 1.04)	0.99	(0.94 - 1.04)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			0.95	(0.91 - 0.99)	0.96	(0.92 - 1.00)	0.96	(0.92 - 1.00)
Maternal education	≤9			1.37	(1.30 - 1.44)	1.35	(1.29 - 1.42)	1.35	(1.29 - 1.42)
	10-12			1.09	(1.04 - 1.13)	1.08	(1.05 - 1.12)	1.09	(1.05 - 1.13)
	13-14			1	ref	1	ref	1	ref
	≥16			0.97	(0.93 - 1.01)	0.96	(0.92 - 1.00)	0.96	(0.92 - 1.00)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			1.37	(1.22 - 1.55)	1.35	(1.21 - 1.51)	1.35	(1.21 - 1.51)
	Gotland			1.62	(1.37 - 1.92)	1.53	(1.31 - 1.80)	1.53	(1.31 - 1.80)
	Gävleborg			0.98	(0.86 - 1.11)	0.95	(0.84 - 1.07)	0.95	(0.84 - 1.06)
	Halland			1.09	(0.97 - 1.23)	1.06	(0.95 - 1.19)	1.06	(0.95 - 1.19)
	Jämtland			1.40	(1.22 - 1.61)	1.35	(1.19 - 1.54)	1.35	(1.19 - 1.54)
	Jönköping			0.99	(0.88 - 1.11)	0.96	(0.86 - 1.07)	0.96	(0.86 - 1.07)
	Kalmar			1.29	(1.14 - 1.46)	1.23	(1.10 - 1.39)	1.23	(1.10 - 1.38)
Kronoberg			0.80	(0.70 - 0.92)	0.78	(0.68 - 0.89)	0.78	(0.68 - 0.88)	

1								
2								
3								
4								
5		Norrbottn	1.29	(1.14 - 1.45)	1.24	(1.10 - 1.38)	1.23	(1.10 - 1.38)
6		Skåne	0.99	(0.89 - 1.10)	0.96	(0.87 - 1.06)	0.96	(0.87 - 1.06)
7		Stockholm	1.04	(0.94 - 1.15)	1.01	(0.92 - 1.11)	1.01	(0.92 - 1.11)
8		Södermanland	1.27	(1.13 - 1.43)	1.23	(1.10 - 1.37)	1.23	(1.10 - 1.37)
9		Uppsala	0.88	(0.78 - 0.99)	0.84	(0.75 - 0.95)	0.84	(0.75 - 0.94)
10		Värmland	0.97	(0.86 - 1.10)	0.94	(0.84 - 1.06)	0.94	(0.84 - 1.06)
11		Västerbotten	1.54	(1.37 - 1.73)	1.47	(1.31 - 1.64)	1.47	(1.31 - 1.64)
12		Västernorrland	1.41	(1.25 - 1.59)	1.33	(1.19 - 1.49)	1.33	(1.19 - 1.49)
13		Västmanland	1.23	(1.09 - 1.38)	1.17	(1.04 - 1.31)	1.17	(1.04 - 1.31)
14		Västra Götaland	1.12	(1.01 - 1.24)	1.09	(0.99 - 1.20)	1.09	(0.99 - 1.20)
15		Örebro	0.87	(0.77 - 0.99)	0.86	(0.76 - 0.96)	0.86	(0.76 - 0.96)
16		Östergötland	0.90	(0.80 - 1.01)	0.88	(0.79 - 0.98)	0.88	(0.79 - 0.98)
17								
18	Year	1998	1	ref	1	ref	1	ref
19		1999	0.93	(0.88 - 0.99)	0.94	(0.90 - 0.99)	0.94	(0.90 - 0.99)
20		2000	0.93	(0.88 - 0.98)	0.94	(0.89 - 0.98)	0.94	(0.89 - 0.98)
21		2001	0.85	(0.81 - 0.90)	0.86	(0.90 - 0.97)	0.86	(0.90 - 0.97)
22		2002	0.86	(0.81 - 0.91)	0.86	(0.82 - 0.91)	0.86	(0.82 - 0.91)
23		2003	0.96	(0.91 - 1.01)	0.96	(0.82 - 0.91)	0.96	(0.82 - 0.90)
24		2004	0.90	(0.86 - 0.95)	0.92	(0.91 - 1.00)	0.91	(0.91 - 1.00)
25		2005	0.97	(0.92 - 1.02)	0.98	(0.87 - 0.96)	0.98	(0.87 - 0.96)
26		2006	0.94	(0.89 - 0.99)	0.96	(0.93 - 1.03)	0.96	(0.93 - 1.02)
27								
28								
29	Observations (N)	693,007	693,007		838,756		838,756	

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table F: Upper respiratory tract infections

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	1.02	(0.93 - 1.12)	0.97	(0.88 - 1.06)	0.98	(0.89 - 1.07)	0.98	(0.90 - 1.08)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	1.12	(1.09 - 1.16)	1.08	(1.05 - 1.11)	1.08	(1.04 - 1.11)	1.08	(1.05 - 1.12)
	Obese	1.28	(1.23 - 1.34)	1.19	(1.14 - 1.24)	1.19	(1.15 - 1.25)	1.20	(1.15 - 1.25)
Maternal age	≤19			1.04	(0.93 - 1.16)	1.04	(0.95 - 1.14)	1.04	(0.95 - 1.14)
	20-24			1	ref	1	ref	1	ref
	25-29			0.93	(0.89 - 0.97)	0.91	(0.87 - 0.95)	0.91	(0.87 - 0.95)
	30-34			0.88	(0.84 - 0.92)	0.86	(0.83 - 0.90)	0.86	(0.83 - 0.90)
	≥35			0.85	(0.80 - 0.90)	0.83	(0.79 - 0.88)	0.83	(0.79 - 0.88)
Parity	1			1	ref	1	ref	1	ref
	2			1.15	(1.12 - 1.19)	1.15	(1.12 - 1.19)	1.15	(1.12 - 1.19)
	3			1.14	(1.09 - 1.19)	1.15	(1.11 - 1.20)	1.15	(1.11 - 1.20)
	≥4			1.19	(1.12 - 1.26)	1.24	(1.17 - 1.31)	1.24	(1.17 - 1.30)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			1.05	(1.01 - 1.10)	1.07	(1.02 - 1.11)	1.06	(1.02 - 1.11)
Maternal education	≤9			1.21	(1.14 - 1.28)	1.19	(1.13 - 1.25)	1.19	(1.13 - 1.25)
	10-12			1.05	(1.00 - 1.09)	1.04	(1.00 - 1.08)	1.04	(1.00 - 1.08)
	13-14			1	ref	1	ref	1	ref
	≥16			0.91	(0.87 - 0.96)	0.91	(0.87 - 0.95)	0.90	(0.87 - 0.94)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			0.96	(0.85 - 1.08)	0.96	(0.86 - 1.07)	0.96	(0.86 - 1.07)
	Gotland			1.52	(1.29 - 1.80)	1.51	(1.29 - 1.76)	1.51	(1.29 - 1.76)
	Gävleborg			0.86	(0.76 - 0.97)	0.84	(0.75 - 0.94)	0.84	(0.75 - 0.94)
	Halland			1.00	(0.89 - 1.12)	0.99	(0.89 - 1.11)	0.99	(0.89 - 1.10)
	Jämtland			1.43	(1.25 - 1.63)	1.43	(1.27 - 1.62)	1.43	(1.27 - 1.62)
	Jönköping			0.51	(0.45 - 0.58)	0.51	(0.45 - 0.57)	0.51	(0.45 - 0.57)
	Kalmar			1.04	(0.92 - 1.18)	1.03	(0.92 - 1.16)	1.03	(0.92 - 1.16)
Kronoberg			0.51	(0.44 - 0.58)	0.49	(0.43 - 0.56)	0.49	(0.43 - 0.56)	

1								
2								
3								
4								
5		Norrbottn	0.68	(0.60 - 0.78)	0.70	(0.62 - 0.79)	0.70	(0.62 - 0.79)
6		Skåne	0.75	(0.68 - 0.83)	0.76	(0.69 - 0.83)	0.76	(0.69 - 0.83)
7		Stockholm	0.57	(0.52 - 0.63)	0.57	(0.52 - 0.62)	0.57	(0.52 - 0.62)
8		Södermanland	0.91	(0.80 - 1.02)	0.90	(0.80 - 1.01)	0.90	(0.80 - 1.01)
9		Uppsala	0.73	(0.65 - 0.82)	0.72	(0.65 - 0.81)	0.72	(0.65 - 0.81)
10		Värmland	0.87	(0.77 - 0.98)	0.85	(0.76 - 0.95)	0.85	(0.76 - 0.95)
11		Västerbotten	0.88	(0.78 - 1.00)	0.86	(0.77 - 0.97)	0.86	(0.77 - 0.97)
12		Västernorrland	0.98	(0.87 - 1.11)	1.00	(0.90 - 1.12)	1.00	(0.90 - 1.12)
13		Västmanland	0.94	(0.83 - 1.06)	0.94	(0.84 - 1.05)	0.94	(0.84 - 1.05)
14		Västra						
15		Götaland	0.82	(0.75 - 0.91)	0.81	(0.74 - 0.89)	0.81	(0.74 - 0.89)
16		Örebro	1.18	(1.05 - 1.32)	1.17	(1.05 - 1.30)	1.17	(1.05 - 1.30)
17		Östergötland	0.77	(0.69 - 0.86)	0.76	(0.68 - 0.85)	0.76	(0.68 - 0.84)
18	Year	1998	1	ref	1	ref	1	ref
19		1999	0.88	(0.83 - 0.93)	0.91	(0.87 - 0.96)	0.91	(0.87 - 0.96)
20		2000	0.82	(0.78 - 0.87)	0.82	(0.78 - 0.87)	0.82	(0.78 - 0.87)
21		2001	0.76	(0.72 - 0.81)	0.78	(0.87 - 0.95)	0.78	(0.87 - 0.95)
22		2002	0.76	(0.72 - 0.80)	0.79	(0.74 - 0.82)	0.79	(0.74 - 0.82)
23		2003	0.71	(0.67 - 0.75)	0.73	(0.75 - 0.83)	0.73	(0.75 - 0.83)
24		2004	0.68	(0.64 - 0.72)	0.70	(0.69 - 0.76)	0.70	(0.69 - 0.76)
25		2005	0.71	(0.67 - 0.76)	0.73	(0.66 - 0.73)	0.73	(0.66 - 0.73)
26		2006	0.71	(0.67 - 0.75)	0.74	(0.69 - 0.77)	0.74	(0.69 - 0.77)
27		Observations (N)	693,007	693,007	838,756	838,756		

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table G: Genitourinary infections

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	1.14	(0.98 - 1.33)	1.13	(0.97 - 1.32)	1.13	(0.98 - 1.30)	1.14	(0.99 - 1.32)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	1.12	(1.06 - 1.18)	1.12	(1.05 - 1.18)	1.11	(1.05 - 1.18)	1.12	(1.05 - 1.18)
	Obese	1.28	(1.18 - 1.37)	1.27	(1.17 - 1.37)	1.25	(1.16 - 1.35)	1.25	(1.16 - 1.35)
Maternal age	≤19			1.00	(0.81 - 1.23)	1.03	(0.87 - 1.22)	1.03	(0.87 - 1.22)
	20-24			1	ref	1	ref	1	ref
	25-29			1.05	(0.97 - 1.14)	1.01	(0.94 - 1.09)	1.01	(0.94 - 1.09)
	30-34			0.98	(0.90 - 1.07)	0.94	(0.87 - 1.02)	0.94	(0.87 - 1.02)
	≥35			0.94	(0.86 - 1.04)	0.94	(0.86 - 1.03)	0.94	(0.86 - 1.03)
Parity	1			1	ref	1	ref	1	ref
	2			0.99	(0.94 - 1.05)	1.00	(0.95 - 1.05)	1.00	(0.95 - 1.05)
	3			0.91	(0.84 - 0.99)	0.93	(0.86 - 1.00)	0.93	(0.86 - 1.00)
	≥4			1.00	(0.90 - 1.12)	1.01	(0.91 - 1.11)	1.01	(0.92 - 1.12)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			0.94	(0.86 - 1.02)	0.92	(0.85 - 1.00)	0.93	(0.85 - 1.01)
Maternal education	≤9			1.09	(0.99 - 1.20)	1.11	(1.01 - 1.21)	1.09	(1.00 - 1.20)
	10-12			1.02	(0.95 - 1.10)	1.03	(0.97 - 1.10)	1.03	(0.96 - 1.10)
	13-14			1	ref	1	ref	1	ref
	≥16			0.96	(0.89 - 1.04)	0.96	(0.89 - 1.04)	0.96	(0.89 - 1.03)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			0.98	(0.80 - 1.21)	1.00	(0.82 - 1.22)	1.00	(0.82 - 1.22)
	Gotland			0.68	(0.47 - 0.99)	0.73	(0.52 - 1.02)	0.73	(0.52 - 1.02)
	Gävleborg			0.59	(0.47 - 0.74)	0.61	(0.49 - 0.75)	0.61	(0.49 - 0.75)
	Halland			1.00	(0.81 - 1.23)	0.97	(0.79 - 1.17)	0.97	(0.80 - 1.17)
	Jämtland			0.62	(0.46 - 0.82)	0.70	(0.54 - 0.90)	0.70	(0.54 - 0.90)
	Jönköping			0.66	(0.54 - 0.81)	0.65	(0.53 - 0.79)	0.65	(0.53 - 0.79)
	Kalmar			0.72	(0.57 - 0.91)	0.74	(0.59 - 0.92)	0.74	(0.59 - 0.92)
Kronoberg			0.62	(0.49 - 0.80)	0.63	(0.50 - 0.80)	0.63	(0.50 - 0.80)	

1								
2								
3								
4								
5		Norrbottn	0.78	(0.62 - 0.97)	0.76	(0.61 - 0.94)	0.76	(0.62 - 0.94)
6		Skåne	0.92	(0.77 - 1.10)	0.93	(0.79 - 1.10)	0.93	(0.79 - 1.10)
7		Stockholm	0.67	(0.56 - 0.80)	0.65	(0.55 - 0.77)	0.65	(0.55 - 0.77)
8		Södermanland	0.64	(0.51 - 0.81)	0.64	(0.52 - 0.79)	0.64	(0.52 - 0.79)
9		Uppsala	0.72	(0.58 - 0.89)	0.74	(0.61 - 0.90)	0.74	(0.61 - 0.90)
10		Värmland	0.60	(0.48 - 0.76)	0.64	(0.51 - 0.79)	0.64	(0.51 - 0.79)
11		Västerbotten	0.81	(0.65 - 1.01)	0.78	(0.64 - 0.96)	0.78	(0.64 - 0.96)
12		Västernorrland	0.65	(0.51 - 0.83)	0.70	(0.56 - 0.86)	0.70	(0.56 - 0.86)
13		Västmanland	0.83	(0.67 - 1.03)	0.82	(0.67 - 1.01)	0.82	(0.67 - 1.01)
14		Västra						
15		Götaland	1.20	(1.01 - 1.42)	1.18	(1.00 - 1.39)	1.18	(1.00 - 1.39)
16		Örebro	0.76	(0.61 - 0.94)	0.80	(0.66 - 0.98)	0.80	(0.66 - 0.98)
17		Östergötland	0.59	(0.48 - 0.73)	0.59	(0.49 - 0.72)	0.59	(0.49 - 0.72)
18	Year	1998	1	ref	1	ref	1	ref
19		1999	0.95	(0.85 - 1.05)	0.97	(0.88 - 1.06)	0.97	(0.88 - 1.06)
20		2000	0.96	(0.86 - 1.07)	0.94	(0.86 - 1.03)	0.94	(0.86 - 1.03)
21		2001	0.93	(0.84 - 1.03)	0.90	(0.94 - 1.09)	0.90	(0.94 - 1.09)
22		2002	1.02	(0.92 - 1.13)	0.97	(0.82 - 0.99)	0.97	(0.82 - 0.99)
23		2003	1.00	(0.90 - 1.11)	0.97	(0.89 - 1.07)	0.97	(0.89 - 1.07)
24		2004	0.98	(0.89 - 1.09)	0.96	(0.88 - 1.06)	0.96	(0.88 - 1.06)
25		2005	0.90	(0.81 - 1.00)	0.90	(0.88 - 1.05)	0.90	(0.88 - 1.05)
26		2006	0.89	(0.80 - 0.98)	0.90	(0.82 - 0.98)	0.90	(0.82 - 0.98)
27	Observations (N)	693,007	693,007		838,756		838,756	

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table H: Perinatal infections

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	0.84	(0.66 - 1.06)	0.84	(0.67 - 1.06)	0.89	(0.71 - 1.11)	0.87	(0.68 - 1.11)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	1.31	(1.22 - 1.40)	1.34	(1.25 - 1.44)	1.31	(1.22 - 1.40)	1.30	(1.21 - 1.39)
	Obese	1.63	(1.49 - 1.78)	1.72	(1.57 - 1.88)	1.64	(1.50 - 1.79)	1.65	(1.50 - 1.81)
Maternal age	≤19			1.03	(0.81 - 1.30)	0.93	(0.75 - 1.15)	0.93	(0.75 - 1.15)
	20-24			1	ref	1	ref	1	ref
	25-29			1.12	(1.01 - 1.23)	1.14	(1.04 - 1.25)	1.14	(1.04 - 1.24)
	30-34			1.24	(1.12 - 1.38)	1.26	(1.14 - 1.38)	1.26	(1.14 - 1.38)
	≥35			1.47	(1.30 - 1.66)	1.49	(1.34 - 1.66)	1.49	(1.33 - 1.66)
Parity	1			1	ref	1	ref	1	ref
	2			0.44	(0.41 - 0.48)	0.45	(0.42 - 0.48)	0.45	(0.42 - 0.48)
	3			0.39	(0.35 - 0.44)	0.40	(0.36 - 0.44)	0.40	(0.36 - 0.44)
	≥4			0.37	(0.31 - 0.43)	0.38	(0.33 - 0.44)	0.38	(0.33 - 0.44)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			1.11	(1.00 - 1.22)	1.10	(1.00 - 1.20)	1.09	(1.00 - 1.20)
Maternal education	≤9			1.01	(0.89 - 1.15)	1.03	(0.92 - 1.16)	1.03	(0.91 - 1.16)
	10-12			0.99	(0.91 - 1.09)	1.02	(0.94 - 1.11)	1.02	(0.94 - 1.11)
	13-14			1	ref	1	ref	1	ref
	≥16			0.93	(0.84 - 1.03)	0.94	(0.86 - 1.03)	0.94	(0.85 - 1.03)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			0.84	(0.59 - 1.18)	0.91	(0.66 - 1.26)	0.91	(0.66 - 1.26)
	Gotland			1.44	(0.91 - 2.28)	1.55	(1.01 - 2.37)	1.55	(1.01 - 2.38)
	Gävleborg			0.92	(0.66 - 1.30)	0.95	(0.69 - 1.30)	0.94	(0.68 - 1.30)
	Halland			1.59	(1.17 - 2.15)	1.63	(1.22 - 2.18)	1.63	(1.22 - 2.18)
	Jämtland			1.88	(1.33 - 2.65)	1.95	(1.41 - 2.70)	1.95	(1.41 - 2.69)
	Jönköping			0.30	(0.20 - 0.45)	0.30	(0.21 - 0.45)	0.30	(0.20 - 0.45)
	Kalmar			2.35	(1.74 - 3.18)	2.43	(1.82 - 3.25)	2.43	(1.82 - 3.25)
Kronoberg			1.54	(1.12 - 2.14)	1.63	(1.19 - 2.22)	1.63	(1.19 - 2.22)	

1								
2								
3								
4								
5		Norrbottn	2.00	(1.48 - 2.71)	1.96	(1.46 - 2.62)	1.95	(1.46 - 2.61)
6		Skåne	1.16	(0.88 - 1.53)	1.17	(0.89 - 1.52)	1.16	(0.89 - 1.52)
7		Stockholm	0.43	(0.33 - 0.58)	0.43	(0.33 - 0.56)	0.43	(0.33 - 0.56)
8		Södermanland	1.41	(1.03 - 1.93)	1.45	(1.08 - 1.96)	1.45	(1.08 - 1.96)
9		Uppsala	0.41	(0.28 - 0.61)	0.40	(0.27 - 0.57)	0.40	(0.27 - 0.57)
10		Värmland	0.47	(0.31 - 0.70)	0.49	(0.34 - 0.71)	0.49	(0.33 - 0.71)
11		Västerbotten	1.45	(1.06 - 2.00)	1.49	(1.11 - 2.02)	1.49	(1.10 - 2.01)
12		Västernorrland	1.56	(1.13 - 2.16)	1.57	(1.16 - 2.11)	1.56	(1.16 - 2.11)
13		Västmanland	0.87	(0.62 - 1.22)	0.88	(0.64 - 1.23)	0.88	(0.64 - 1.22)
14		Västra						
15		Götaland	3.24	(2.48 - 4.23)	3.19	(2.47 - 4.12)	3.18	(2.46 - 4.12)
16		Örebro	1.70	(1.25 - 2.32)	1.58	(1.18 - 2.12)	1.58	(1.18 - 2.12)
17		Östergötland	0.32	(0.22 - 0.46)	0.33	(0.23 - 0.47)	0.33	(0.23 - 0.47)
18		Year						
19		1998	1	ref	1	ref	1	ref
20		1999	0.83	(0.73 - 0.94)	0.82	(0.73 - 0.92)	0.82	(0.73 - 0.92)
21		2000	0.84	(0.74 - 0.95)	0.86	(0.76 - 0.96)	0.86	(0.76 - 0.96)
22		2001	0.77	(0.68 - 0.88)	0.75	(1.04 - 1.25)	0.75	(1.04 - 1.24)
23		2002	0.82	(0.72 - 0.93)	0.82	(0.67 - 0.84)	0.82	(0.67 - 0.84)
24		2003	0.70	(0.62 - 0.80)	0.70	(0.73 - 0.91)	0.70	(0.73 - 0.91)
25		2004	0.68	(0.60 - 0.77)	0.67	(0.62 - 0.78)	0.67	(0.62 - 0.78)
26		2005	0.69	(0.61 - 0.79)	0.66	(0.59 - 0.75)	0.66	(0.59 - 0.75)
27		2006	0.75	(0.66 - 0.85)	0.72	(0.59 - 0.74)	0.72	(0.59 - 0.74)
28		Observations (N)	693,007	693,007	838,756	838,756		

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table I: Skin & soft tissue infections

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	0.90	(0.70 - 1.15)	0.90	(0.70 - 1.15)	0.95	(0.75 - 1.21)	0.93	(0.74 - 1.18)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	0.97	(0.89 - 1.06)	0.94	(0.86 - 1.02)	0.96	(0.88 - 1.06)	0.96	(0.88 - 1.05)
	Obese	1.09	(0.97 - 1.23)	1.02	(0.91 - 1.15)	1.04	(0.93 - 1.16)	1.03	(0.91 - 1.15)
Maternal age	≤19			0.97	(0.69 - 1.35)	1.03	(0.79 - 1.34)	1.03	(0.79 - 1.34)
	20-24			1	ref	1	ref	1	ref
	25-29			1.05	(0.93 - 1.19)	0.96	(0.86 - 1.08)	0.96	(0.86 - 1.08)
	30-34			1.02	(0.89 - 1.16)	0.94	(0.83 - 1.05)	0.94	(0.83 - 1.05)
	≥35			0.92	(0.79 - 1.07)	0.88	(0.77 - 1.00)	0.88	(0.77 - 1.00)
Parity	1			1	ref	1	ref	1	ref
	2			1.23	(1.13 - 1.34)	1.22	(1.13 - 1.32)	1.22	(1.13 - 1.32)
	3			1.28	(1.14 - 1.44)	1.29	(1.16 - 1.43)	1.29	(1.16 - 1.43)
	≥4			1.58	(1.35 - 1.85)	1.56	(1.36 - 1.80)	1.57	(1.36 - 1.80)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			1.02	(0.91 - 1.16)	1.05	(0.94 - 1.18)	1.05	(0.94 - 1.18)
Maternal education	≤9			1.14	(0.99 - 1.33)	1.15	(1.00 - 1.31)	1.15	(1.01 - 1.32)
	10-12			1.04	(0.93 - 1.17)	1.05	(0.95 - 1.16)	1.06	(0.96 - 1.18)
	13-14			1	ref	1	ref	1	ref
	≥16			0.95	(0.84 - 1.07)	0.96	(0.86 - 1.07)	0.97	(0.86 - 1.08)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			1.05	(0.75 - 1.48)	1.07	(0.77 - 1.48)	1.07	(0.78 - 1.48)
	Gotland			0.75	(0.41 - 1.37)	0.84	(0.49 - 1.45)	0.84	(0.49 - 1.45)
	Gävleborg			0.84	(0.58 - 1.20)	0.82	(0.58 - 1.15)	0.82	(0.58 - 1.15)
	Halland			0.97	(0.69 - 1.37)	1.01	(0.73 - 1.39)	1.01	(0.73 - 1.39)
	Jämtland			1.34	(0.91 - 1.99)	1.22	(0.84 - 1.78)	1.22	(0.84 - 1.78)
	Jönköping			0.78	(0.55 - 1.09)	0.77	(0.56 - 1.06)	0.77	(0.56 - 1.06)
	Kalmar			1.14	(0.80 - 1.62)	1.11	(0.79 - 1.55)	1.10	(0.79 - 1.54)
Kronoberg			0.88	(0.60 - 1.29)	0.90	(0.63 - 1.30)	0.90	(0.63 - 1.30)	

1								
2								
3								
4								
5		Norrbottn	0.94	(0.66 - 1.35)	0.95	(0.68 - 1.33)	0.95	(0.68 - 1.33)
6		Skåne	1.13	(0.84 - 1.51)	1.14	(0.86 - 1.50)	1.14	(0.86 - 1.50)
7		Stockholm	1.03	(0.77 - 1.36)	1.03	(0.79 - 1.35)	1.03	(0.79 - 1.35)
8		Södermanland	0.83	(0.58 - 1.19)	0.83	(0.59 - 1.16)	0.83	(0.59 - 1.16)
9		Uppsala	0.84	(0.59 - 1.18)	0.90	(0.65 - 1.23)	0.90	(0.65 - 1.23)
10		Värmland	0.79	(0.55 - 1.14)	0.75	(0.53 - 1.06)	0.75	(0.53 - 1.06)
11		Västerbotten	0.77	(0.53 - 1.12)	0.76	(0.54 - 1.08)	0.76	(0.54 - 1.08)
12		Västernorrland	1.34	(0.94 - 1.89)	1.37	(0.99 - 1.88)	1.37	(0.99 - 1.88)
13		Västmanland	1.07	(0.76 - 1.51)	1.04	(0.75 - 1.45)	1.04	(0.75 - 1.45)
14		Västra						
15		Götaland	1.16	(0.87 - 1.54)	1.18	(0.90 - 1.54)	1.18	(0.90 - 1.54)
16		Örebro	0.81	(0.57 - 1.17)	0.81	(0.58 - 1.14)	0.81	(0.58 - 1.14)
17		Östergötland	0.78	(0.56 - 1.08)	0.81	(0.59 - 1.11)	0.81	(0.59 - 1.11)
18	Year	1998	1	ref	1	ref	1	ref
19		1999	1.05	(0.88 - 1.24)	1.06	(0.91 - 1.23)	1.06	(0.91 - 1.23)
20		2000	1.01	(0.85 - 1.20)	0.98	(0.85 - 1.14)	0.98	(0.85 - 1.14)
21		2001	1.19	(1.01 - 1.40)	1.18	(0.86 - 1.08)	1.18	(0.86 - 1.08)
22		2002	1.19	(1.02 - 1.40)	1.15	(1.02 - 1.36)	1.15	(1.02 - 1.36)
23		2003	1.33	(1.14 - 1.56)	1.29	(0.99 - 1.33)	1.29	(0.99 - 1.33)
24		2004	1.17	(1.00 - 1.38)	1.13	(1.12 - 1.49)	1.13	(1.12 - 1.49)
25		2005	1.18	(1.00 - 1.39)	1.13	(0.98 - 1.31)	1.13	(0.98 - 1.31)
26		2006	1.25	(1.07 - 1.46)	1.23	(0.98 - 1.30)	1.23	(0.98 - 1.30)
27	Observations (N)	693,007	693,007		838,756		838,756	

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table J: Neurological and eye infections

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	0.90	(0.62 - 1.31)	0.87	(0.59 - 1.27)	0.85	(0.59 - 1.22)	0.84	(0.59 - 1.19)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	0.91	(0.79 - 1.04)	0.93	(0.81 - 1.06)	0.95	(0.83 - 1.08)	0.95	(0.83 - 1.08)
	Obese	0.96	(0.80 - 1.15)	1.02	(0.85 - 1.23)	1.05	(0.87 - 1.26)	1.02	(0.85 - 1.24)
Maternal age	≤19			0.98	(0.59 - 1.61)	1.11	(0.75 - 1.66)	1.12	(0.75 - 1.67)
	20-24			1	ref	1	ref	1	ref
	25-29			0.78	(0.65 - 0.94)	0.78	(0.66 - 0.92)	0.78	(0.66 - 0.92)
	30-34			0.75	(0.62 - 0.91)	0.77	(0.65 - 0.92)	0.77	(0.65 - 0.92)
	≥35			0.79	(0.64 - 0.99)	0.80	(0.65 - 0.97)	0.80	(0.65 - 0.97)
Parity	1			1	ref	1	ref	1	ref
	2			1.17	(1.03 - 1.33)	1.15	(1.03 - 1.30)	1.15	(1.03 - 1.30)
	3			1.14	(0.95 - 1.37)	1.23	(1.04 - 1.44)	1.23	(1.04 - 1.44)
	≥4			1.27	(0.98 - 1.65)	1.28	(1.02 - 1.61)	1.29	(1.02 - 1.61)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			1.13	(0.94 - 1.36)	1.15	(0.96 - 1.38)	1.16	(0.98 - 1.38)
Maternal education	≤9			0.77	(0.61 - 0.97)	0.85	(0.68 - 1.05)	0.84	(0.68 - 1.04)
	10-12			0.84	(0.71 - 0.99)	0.89	(0.76 - 1.03)	0.89	(0.77 - 1.03)
	13-14			1	ref	1	ref	1	ref
	≥16			0.91	(0.76 - 1.09)	0.96	(0.81 - 1.13)	0.96	(0.81 - 1.13)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			0.99	(0.57 - 1.71)	1.08	(0.64 - 1.82)	1.08	(0.64 - 1.82)
	Gotland			1.14	(0.49 - 2.64)	1.16	(0.52 - 2.60)	1.16	(0.52 - 2.60)
	Gävleborg			0.78	(0.44 - 1.39)	0.75	(0.43 - 1.31)	0.75	(0.43 - 1.31)
	Halland			1.86	(1.13 - 3.06)	1.90	(1.17 - 3.07)	1.89	(1.17 - 3.07)
	Jämtland			0.89	(0.45 - 1.75)	0.78	(0.40 - 1.51)	0.78	(0.40 - 1.51)
	Jönköping			0.86	(0.51 - 1.45)	1.04	(0.63 - 1.71)	1.04	(0.63 - 1.71)
	Kalmar			0.82	(0.46 - 1.47)	0.80	(0.45 - 1.42)	0.80	(0.45 - 1.42)
Kronoberg			0.66	(0.35 - 1.24)	0.68	(0.37 - 1.25)	0.68	(0.37 - 1.25)	

1								
2								
3								
4								
5		Norrbottn	0.32	(0.16 - 0.66)	0.43	(0.23 - 0.80)	0.43	(0.23 - 0.80)
6		Skåne	1.18	(0.75 - 1.86)	1.26	(0.81 - 1.95)	1.26	(0.81 - 1.95)
7		Stockholm	1.45	(0.93 - 2.26)	1.51	(0.98 - 2.32)	1.51	(0.98 - 2.32)
8		Södermanland	0.84	(0.48 - 1.48)	0.87	(0.51 - 1.48)	0.87	(0.51 - 1.48)
9		Uppsala	0.86	(0.50 - 1.48)	0.88	(0.52 - 1.47)	0.88	(0.52 - 1.46)
10		Värmland	0.48	(0.26 - 0.90)	0.58	(0.32 - 1.03)	0.58	(0.32 - 1.03)
11		Västerbotten	0.89	(0.51 - 1.57)	0.97	(0.57 - 1.65)	0.97	(0.57 - 1.66)
12		Västernorrland	0.57	(0.30 - 1.09)	0.74	(0.42 - 1.29)	0.74	(0.42 - 1.29)
13		Västmanland	1.04	(0.60 - 1.79)	1.09	(0.64 - 1.83)	1.09	(0.64 - 1.84)
14		Västra						
15		Götaland	1.38	(0.88 - 2.16)	1.46	(0.94 - 2.24)	1.46	(0.94 - 2.24)
16		Örebro	0.72	(0.40 - 1.28)	0.77	(0.45 - 1.32)	0.77	(0.45 - 1.32)
17		Östergötland	0.55	(0.32 - 0.94)	0.56	(0.33 - 0.95)	0.56	(0.33 - 0.94)
18		Year						
19		1998	1	ref	1	ref	1	ref
20		1999	0.99	(0.77 - 1.26)	1.00	(0.80 - 1.24)	1.00	(0.80 - 1.24)
21		2000	1.00	(0.78 - 1.27)	0.95	(0.77 - 1.18)	0.95	(0.77 - 1.18)
22		2001	0.97	(0.76 - 1.23)	0.95	(0.66 - 0.92)	0.95	(0.66 - 0.92)
23		2002	0.91	(0.71 - 1.16)	0.89	(0.77 - 1.18)	0.89	(0.77 - 1.18)
24		2003	0.89	(0.70 - 1.13)	0.87	(0.72 - 1.10)	0.87	(0.72 - 1.11)
25		2004	0.86	(0.68 - 1.10)	0.86	(0.70 - 1.08)	0.86	(0.70 - 1.08)
26		2005	0.91	(0.71 - 1.15)	0.88	(0.69 - 1.06)	0.88	(0.69 - 1.06)
27		2006	0.93	(0.74 - 1.18)	0.87	(0.71 - 1.09)	0.87	(0.71 - 1.09)
28		Observations (N)	693,007	693,007	838,756	838,756		

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table K: Digestive tract infections

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	1.32	(0.93 - 1.89)	1.32	(0.92 - 1.88)	1.17	(0.82 - 1.65)	1.18	(0.84 - 1.67)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	0.98	(0.86 - 1.13)	0.97	(0.84 - 1.11)	0.97	(0.85 - 1.12)	0.96	(0.83 - 1.11)
	Obese	1.04	(0.85 - 1.26)	0.99	(0.82 - 1.21)	1.02	(0.85 - 1.23)	1.02	(0.85 - 1.23)
Maternal age	≤19			0.88	(0.52 - 1.50)	0.81	(0.53 - 1.26)	0.81	(0.52 - 1.25)
	20-24			1	ref	1	ref	1	ref
	25-29			0.79	(0.65 - 0.96)	0.76	(0.64 - 0.91)	0.76	(0.64 - 0.91)
	30-34			0.87	(0.70 - 1.07)	0.82	(0.68 - 0.99)	0.82	(0.69 - 0.99)
	≥35			0.72	(0.56 - 0.91)	0.67	(0.54 - 0.83)	0.67	(0.54 - 0.83)
Parity	1			1	ref	1	ref	1	ref
	2			1.22	(1.06 - 1.40)	1.23	(1.08 - 1.39)	1.23	(1.08 - 1.39)
	3			1.53	(1.27 - 1.85)	1.47	(1.24 - 1.74)	1.47	(1.24 - 1.74)
	≥4			1.89	(1.47 - 2.43)	1.90	(1.52 - 2.38)	1.90	(1.52 - 2.38)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			1.10	(0.91 - 1.34)	1.14	(0.95 - 1.37)	1.14	(0.95 - 1.36)
Maternal education	≤9			1.22	(0.95 - 1.55)	1.32	(1.05 - 1.65)	1.33	(1.06 - 1.67)
	10-12			1.05	(0.87 - 1.26)	1.11	(0.94 - 1.32)	1.11	(0.94 - 1.32)
	13-14			1	ref	1	ref	1	ref
	≥16			1.23	(1.01 - 1.50)	1.22	(1.01 - 1.46)	1.22	(1.01 - 1.47)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			1.05	(0.58 - 1.93)	0.99	(0.58 - 1.70)	0.99	(0.58 - 1.71)
	Gotland			1.82	(0.80 - 4.12)	1.50	(0.69 - 3.24)	1.50	(0.70 - 3.24)
	Gävleborg			0.89	(0.47 - 1.65)	0.79	(0.45 - 1.39)	0.79	(0.45 - 1.39)
	Halland			1.31	(0.74 - 2.32)	1.11	(0.66 - 1.87)	1.11	(0.66 - 1.88)
	Jämtland			0.71	(0.32 - 1.59)	0.87	(0.44 - 1.69)	0.87	(0.45 - 1.69)
	Jönköping			1.09	(0.62 - 1.91)	0.92	(0.54 - 1.54)	0.92	(0.55 - 1.54)
	Kalmar			1.11	(0.60 - 2.06)	0.98	(0.56 - 1.73)	0.98	(0.56 - 1.74)
Kronoberg			1.48	(0.81 - 2.72)	1.25	(0.71 - 2.19)	1.25	(0.71 - 2.19)	

1								
2								
3								
4								
5		Norrbottn	0.88	(0.47 - 1.67)	0.78	(0.44 - 1.39)	0.78	(0.44 - 1.39)
6		Skåne	1.38	(0.83 - 2.28)	1.15	(0.73 - 1.82)	1.15	(0.73 - 1.82)
7		Stockholm	1.32	(0.80 - 2.16)	1.14	(0.73 - 1.78)	1.14	(0.73 - 1.78)
8		Södermanland	1.13	(0.62 - 2.06)	0.92	(0.53 - 1.59)	0.92	(0.53 - 1.59)
9		Uppsala	0.64	(0.34 - 1.19)	0.71	(0.41 - 1.23)	0.71	(0.41 - 1.23)
10		Värmland	0.63	(0.32 - 1.23)	0.58	(0.32 - 1.05)	0.57	(0.31 - 1.05)
11		Västerbotten	1.20	(0.66 - 2.19)	1.10	(0.64 - 1.88)	1.10	(0.64 - 1.89)
12		Västernorrland	1.35	(0.73 - 2.48)	1.15	(0.67 - 1.97)	1.15	(0.67 - 1.98)
13		Västmanland	0.92	(0.50 - 1.70)	0.74	(0.42 - 1.31)	0.74	(0.42 - 1.31)
14		Västra						
15		Götaland	1.53	(0.93 - 2.51)	1.31	(0.84 - 2.05)	1.31	(0.84 - 2.05)
16		Örebro	1.02	(0.55 - 1.87)	0.91	(0.53 - 1.57)	0.91	(0.53 - 1.57)
17		Östergötland	1.06	(0.61 - 1.85)	0.88	(0.53 - 1.46)	0.88	(0.53 - 1.46)
18	Year	1998	1	ref	1	ref	1	ref
19		1999	0.98	(0.75 - 1.28)	0.94	(0.74 - 1.18)	0.94	(0.74 - 1.18)
20		2000	1.01	(0.77 - 1.31)	0.97	(0.77 - 1.22)	0.97	(0.77 - 1.22)
21		2001	1.09	(0.85 - 1.41)	1.02	(0.64 - 0.91)	1.02	(0.64 - 0.91)
22		2002	0.96	(0.74 - 1.24)	0.87	(0.81 - 1.28)	0.87	(0.81 - 1.28)
23		2003	0.90	(0.70 - 1.17)	0.87	(0.69 - 1.09)	0.87	(0.69 - 1.09)
24		2004	1.16	(0.91 - 1.49)	1.02	(0.69 - 1.09)	1.02	(0.69 - 1.09)
25		2005	0.88	(0.67 - 1.14)	0.86	(0.82 - 1.27)	0.86	(0.82 - 1.27)
26		2006	1.02	(0.79 - 1.30)	0.96	(0.69 - 1.09)	0.96	(0.69 - 1.09)
27		Observations (N)	693,007	693,007	838,756	838,756		

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table L: Bloodstream infections

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	0.94	(0.50 - 1.79)	1.04	(0.55 - 1.97)	1.06	(0.56 - 1.99)	1.04	(0.58 - 1.88)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	1.12	(0.90 - 1.39)	1.08	(0.87 - 1.34)	1.06	(0.87 - 1.31)	1.07	(0.86 - 1.32)
	Obese	1.02	(0.74 - 1.39)	1.05	(0.76 - 1.44)	1.14	(0.85 - 1.55)	1.12	(0.82 - 1.55)
Maternal age	≤19			1.24	(0.55 - 2.80)	1.08	(0.54 - 2.15)	1.07	(0.54 - 2.13)
	20-24			1	ref	1	ref	1	ref
	25-29			1.13	(0.82 - 1.57)	1.12	(0.85 - 1.49)	1.13	(0.85 - 1.50)
	30-34			1.20	(0.86 - 1.68)	1.06	(0.79 - 1.43)	1.07	(0.80 - 1.44)
	≥35			0.90	(0.61 - 1.32)	0.88	(0.63 - 1.22)	0.88	(0.63 - 1.23)
Parity	1			1	ref	1	ref	1	ref
	2			0.89	(0.71 - 1.11)	0.97	(0.80 - 1.18)	0.97	(0.80 - 1.18)
	3			1.64	(1.24 - 2.16)	1.52	(1.18 - 1.95)	1.51	(1.17 - 1.94)
	≥4			1.25	(0.82 - 1.90)	1.27	(0.88 - 1.83)	1.27	(0.88 - 1.82)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			0.75	(0.53 - 1.05)	0.85	(0.62 - 1.16)	0.87	(0.63 - 1.22)
Maternal education	≤9			1.40	(0.95 - 2.06)	1.29	(0.91 - 1.82)	1.31	(0.92 - 1.86)
	10-12			1.04	(0.78 - 1.38)	1.13	(0.87 - 1.46)	1.11	(0.86 - 1.43)
	13-14			1	ref	1	ref	1	ref
	≥16			1.07	(0.79 - 1.46)	1.04	(0.79 - 1.37)	1.03	(0.78 - 1.36)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			5.26	(1.35 - 20.46)	5.45	(1.43 - 20.72)	5.47	(1.44 - 20.77)
	Gotland			7.44	(1.38 - 40.21)	7.45	(1.44 - 38.54)	7.48	(1.45 - 38.75)
	Gävleborg			6.75	(1.74 - 26.08)	7.61	(2.03 - 28.43)	7.63	(2.04 - 28.51)
	Halland			5.14	(1.34 - 19.71)	5.85	(1.56 - 21.85)	5.85	(1.56 - 21.88)
	Jämtland			2.36	(0.46 - 12.03)	3.54	(0.79 - 15.93)	3.56	(0.79 - 16.01)
	Jönköping			5.16	(1.37 - 19.36)	5.67	(1.54 - 20.86)	5.67	(1.54 - 20.89)
	Kalmar			7.49	(1.91 - 29.40)	8.31	(2.18 - 31.74)	8.30	(2.17 - 31.71)
Kronoberg			4.04	(0.96 - 16.94)	4.74	(1.17 - 19.21)	4.74	(1.17 - 19.20)	

1									
2									
3									
4									
5		Norrbottn	9.72	(2.53 - 37.27)	11.20	(3.02 - 41.56)	11.21	(3.02 - 41.61)	
6		Skåne	4.61	(1.30 - 16.39)	5.34	(1.53 - 18.67)	5.33	(1.53 - 18.64)	
7		Stockholm	7.16	(2.04 - 25.11)	8.94	(2.59 - 30.83)	8.94	(2.59 - 30.82)	
8		Södermanland	4.96	(1.27 - 19.38)	5.42	(1.43 - 20.50)	5.42	(1.43 - 20.52)	
9		Uppsala	3.64	(0.94 - 14.15)	4.22	(1.12 - 15.82)	4.22	(1.12 - 15.81)	
10		Värmland	3.50	(0.87 - 14.12)	5.86	(1.54 - 22.28)	5.84	(1.54 - 22.20)	
11		Västerbotten	7.65	(1.99 - 29.47)	8.19	(2.20 - 30.55)	8.21	(2.20 - 30.62)	
12		Västernorrland	4.65	(1.14 - 18.94)	6.59	(1.73 - 25.07)	6.59	(1.73 - 25.08)	
13		Västmanland	3.36	(0.84 - 13.36)	3.75	(0.97 - 14.51)	3.75	(0.97 - 14.50)	
14		Västra							
15		Götaland	8.09	(2.30 - 28.44)	9.41	(2.72 - 32.55)	9.42	(2.72 - 32.56)	
16		Örebro	1.61	(0.37 - 7.07)	2.50	(0.63 - 9.94)	2.50	(0.63 - 9.96)	
17		Östergötland	6.76	(1.84 - 24.85)	7.47	(2.07 - 26.97)	7.48	(2.07 - 26.98)	
18		Year	1998	1	ref	1	ref	1	ref
19			1999	0.79	(0.50 - 1.25)	0.82	(0.55 - 1.22)	0.82	(0.55 - 1.22)
20			2000	1.40	(0.91 - 2.16)	1.21	(0.83 - 1.75)	1.21	(0.83 - 1.75)
21			2001	1.32	(0.86 - 2.02)	1.12	(0.85 - 1.49)	1.12	(0.85 - 1.50)
22			2002	1.32	(0.86 - 2.01)	1.31	(0.77 - 1.63)	1.32	(0.77 - 1.63)
23			2003	1.42	(0.94 - 2.16)	1.24	(0.91 - 1.90)	1.25	(0.91 - 1.90)
24			2004	1.50	(0.99 - 2.27)	1.54	(0.86 - 1.79)	1.54	(0.86 - 1.80)
25			2005	1.84	(1.22 - 2.77)	1.77	(1.08 - 2.20)	1.77	(1.08 - 2.20)
26			2006	1.78	(1.19 - 2.66)	1.78	(1.24 - 2.52)	1.78	(1.24 - 2.52)
27		Observations (N)	693,007	693,007	838,756	838,756			

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table M: Other infections

Variables		Crude IRR (95% CI)		Adjusted IRR* (95% CI)		MI-model 1 IRR†(95% CI)		MI-model 2 IRR‡ (95% CI)	
Pregnancy BMI	Underweight	1.08	(0.97 - 1.20)	1.03	(0.92 - 1.14)	1.04	(0.94 - 1.16)	1.03	(0.93 - 1.15)
	Normal	1	ref	1	ref	1	ref	1	ref
	Overweight	1.09	(1.05 - 1.13)	1.05	(1.01 - 1.10)	1.06	(1.02 - 1.10)	1.06	(1.02 - 1.10)
	Obese	1.25	(1.19 - 1.32)	1.17	(1.11 - 1.23)	1.18	(1.12 - 1.24)	1.17	(1.11 - 1.23)
Maternal age	≤19			1.03	(0.90 - 1.18)	1.09	(0.98 - 1.22)	1.09	(0.98 - 1.22)
	20-24			1	ref	1	ref	1	ref
	25-29			0.90	(0.85 - 0.95)	0.90	(0.85 - 0.94)	0.90	(0.85 - 0.94)
	30-34			0.83	(0.79 - 0.88)	0.83	(0.79 - 0.88)	0.83	(0.79 - 0.88)
	≥35			0.78	(0.73 - 0.83)	0.79	(0.74 - 0.83)	0.79	(0.74 - 0.83)
Parity	1			1	ref	1	ref	1	ref
	2			1.23	(1.18 - 1.27)	1.21	(1.17 - 1.25)	1.21	(1.17 - 1.25)
	3			1.24	(1.18 - 1.31)	1.23	(1.17 - 1.29)	1.23	(1.17 - 1.29)
	≥4			1.37	(1.27 - 1.47)	1.40	(1.31 - 1.49)	1.40	(1.31 - 1.49)
Maternal smoking	No smoking			1	ref	1	ref	1	ref
	Smoking			1.10	(1.04 - 1.16)	1.09	(1.04 - 1.14)	1.09	(1.04 - 1.15)
Maternal education	≤9			1.23	(1.15 - 1.32)	1.26	(1.18 - 1.33)	1.26	(1.18 - 1.34)
	10-12			1.03	(0.98 - 1.08)	1.05	(1.00 - 1.10)	1.05	(1.00 - 1.10)
	13-14			1	ref	1	ref	1	ref
	≥16			0.97	(0.91 - 1.02)	0.97	(0.92 - 1.02)	0.97	(0.92 - 1.02)
Region	Blekinge			1	ref	1	ref	1	ref
	Dalarna			1.51	(1.30 - 1.74)	1.58	(1.37 - 1.81)	1.58	(1.37 - 1.81)
	Gotland			1.42	(1.14 - 1.76)	1.44	(1.18 - 1.77)	1.44	(1.17 - 1.77)
	Gävleborg			0.73	(0.62 - 0.86)	0.76	(0.65 - 0.89)	0.76	(0.65 - 0.89)
	Halland			1.21	(1.05 - 1.40)	1.27	(1.10 - 1.46)	1.26	(1.10 - 1.45)
	Jämtland			1.44	(1.22 - 1.72)	1.49	(1.27 - 1.75)	1.49	(1.27 - 1.75)
	Jönköping			0.89	(0.77 - 1.03)	0.90	(0.78 - 1.04)	0.90	(0.78 - 1.04)
	Kalmar			1.16	(0.99 - 1.35)	1.19	(1.03 - 1.38)	1.19	(1.03 - 1.38)
Kronoberg			0.70	(0.59 - 0.84)	0.72	(0.61 - 0.86)	0.72	(0.61 - 0.86)	

1								
2								
3								
4								
5		Norrbottn	1.43	(1.24 - 1.67)	1.45	(1.26 - 1.67)	1.45	(1.26 - 1.67)
6		Skåne	1.02	(0.90 - 1.17)	1.06	(0.94 - 1.20)	1.06	(0.94 - 1.20)
7		Stockholm	0.85	(0.75 - 0.97)	0.86	(0.76 - 0.97)	0.86	(0.76 - 0.97)
8		Södermanland	0.86	(0.73 - 1.01)	0.90	(0.78 - 1.05)	0.90	(0.78 - 1.05)
9		Uppsala	0.77	(0.66 - 0.90)	0.78	(0.67 - 0.90)	0.78	(0.67 - 0.90)
10		Värmland	0.86	(0.73 - 1.01)	0.87	(0.75 - 1.02)	0.87	(0.75 - 1.02)
11		Västerbotten	1.26	(1.08 - 1.47)	1.29	(1.12 - 1.49)	1.29	(1.12 - 1.49)
12		Västernorrland	1.03	(0.87 - 1.21)	1.07	(0.92 - 1.24)	1.07	(0.92 - 1.24)
13		Västmanland	0.90	(0.77 - 1.05)	0.89	(0.77 - 1.04)	0.89	(0.77 - 1.04)
14		Västra						
15		Götaland	1.04	(0.92 - 1.19)	1.08	(0.95 - 1.22)	1.08	(0.95 - 1.22)
16		Örebro	1.00	(0.86 - 1.17)	1.05	(0.91 - 1.21)	1.05	(0.91 - 1.21)
17		Östergötland	0.67	(0.58 - 0.78)	0.70	(0.61 - 0.81)	0.70	(0.61 - 0.81)
18	Year	1998	1	ref	1	ref	1	ref
19		1999	1.03	(0.96 - 1.10)	1.02	(0.96 - 1.09)	1.02	(0.96 - 1.09)
20		2000	1.00	(0.93 - 1.07)	0.99	(0.93 - 1.05)	0.99	(0.93 - 1.05)
21		2001	0.86	(0.80 - 0.92)	0.86	(0.85 - 0.94)	0.86	(0.85 - 0.94)
22		2002	0.91	(0.85 - 0.98)	0.89	(0.80 - 0.92)	0.89	(0.80 - 0.92)
23		2003	0.88	(0.82 - 0.94)	0.88	(0.84 - 0.95)	0.88	(0.84 - 0.95)
24		2004	0.83	(0.77 - 0.89)	0.83	(0.83 - 0.94)	0.83	(0.83 - 0.94)
25		2005	0.88	(0.82 - 0.94)	0.87	(0.78 - 0.89)	0.87	(0.78 - 0.89)
26		2006	0.95	(0.89 - 1.01)	0.95	(0.82 - 0.93)	0.95	(0.82 - 0.93)
27		Observations (N)	693,007	693,007	838,756	838,756		

* Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

† Missing information imputed using multiple imputation. Sequential imputation in the order: region, maternal education, maternal smoking and pregnancy BMI. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

‡ Missing information imputed using multiple imputation. Sequential imputation in the order: pregnancy BMI, maternal smoking, maternal education and region. Adjusted for maternal age, maternal education level, maternal smoking, number of previous births, geographic region and year of birth.

Crude and adjusted analyses excluded children with missing data, leaving 693,007 children. Imputation models included all 838,756 children.