Table 1. *Maternal health before and during pregnancy*

|  |  |
| --- | --- |
| Maternal health measure | n (%) |
| Doctor diagnosed illness  Before pregnancy only[[1]](#footnote-1) (n = 6822)  Before and during pregnancy[[2]](#footnote-2) (n = 6822)  Pregnancy only[[3]](#footnote-3) (n = 6822) | 1994 (29)  1199 (18)  615 (9) |
| Current Disability (n = 6179)  Yes[[4]](#footnote-4)  No | 384 (6)  5795 (94) |
| Maternal pre-pregnancy BMI (n = 5971)  Underweight  Normal  Overweight  Obese | 256 (4)  3261 (55)  1349 (23)  1105 (19) |
| Weight gain during pregnancy (n = 5507)  0 (or weight loss)  1-5kg  6-10kg  11-15kg  16-20kg  >20kg | 223 (4)  672 (12)  2079 (38)  1588 (29)  597 (11)  348 (6) |
| Maternal Smoking (n = 6161)  No smoking (before or during)  Stopped smoking for pregnancy  Continued smoking during pregnancy | 4904 (80)  610 (10)  647 (10) |
| Alcohol use before pregnancy (n = 6805)  No alcohol  Less than 1 drink per week  1 drink per week  2+ drinks per week | 1982 (29)  1238 (18)  432 (6)  3153 (46) |
| Alcohol use first trimester (n = 6804)  No alcohol  Less than 1 drink per week  1 drink per week  2+ drinks per week | 5266 (77)  613 (9)  168 (2)  757 (11) |
| Alcohol use rest of pregnancy (n = 6810)  No alcohol  Less than 1 drink per week  1 drink per week  2+ drinks per week | 5898 (87)  635 (9)  112 (2)  165 (2) |

Table 2. *Adjusted logistic regressions: maternal health status, smoking and alcohol modelling birth outcomes*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | LBW: OR (95% CI)† | PTB: OR (95% CI)† | SGA: OR (95% CI)† | Caesarean: OR (95% CI)† |
| Doctor diagnosed illness before pregnancy |  |  |  |  |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 0.85 (0.63 -1.13) | 1.02 (0.80 - 1.29) | 1.04 (0.86, 1.26) | 1.33 (1.17 - 1.52) \*\*\*\* |
| Doctor diagnosed illness before and during pregnancy |  |  |  |  |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 1.00 (0.71 - 1.37) | 1.12 (0.85 - 1.46) | 1.01 (0.81, 1.26) | 1.08 (0.92 - 1.25) |
| Doctor diagnosed illness during pregnancy |  |  |  |  |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 1.74 (1.20 - 2.47) \*\* | 1.38 (0.97 - 1.92) | 1.28 (0.96, 1.67) | 1.21 (0.99 - 1.48) |
| Current disability |  |  |  |  |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 1.26 (0.76 - 1.98) | 0.95 (0.59 - 1.47) | 1.19 (0.83, 1.65) | 1.25 (0.98 - 1.58) |
| Smoking |  |  |  |  |
| Any smoking during pregnancy | 1.93 (1.24 - 2.95) \* | 1.63 (1.10 - 2.36) \* | 2.16 (1.60, 2.90) \*\*\*\* | 0.76 (0.58 - 0.98) \* |
| Stopped smoking | 1.47 (0.93 - 2.25) | 1.02 (0.66 - 1.51) | 1.47 (1.09, 1.96) \* | 1.15 (0.93 - 1.42) |
| Non-smokers | 1.00 | 1.00 | 1.00 | 1.00 |
| Alcohol use before pregnancy |  |  |  |  |
| No alcohol | 1.00 | 1.00 | 1.00 | 1.00 |
| Less than 1 drink per week | 0.82 (0.56 - 1.19) | 0.90 (0.65 - 1.23) | 0.82 (0.63, 1.07) | 0.99 (0.82 - 1.18) |
| 1 drink per week | 0.88 (0.49 - 1.51) | 0.94 (0.58 - 1.48) | 0.93 (0.62, 1.36) | 1.08 (0.83 - 1.39) |
| 2+ drinks per week | 0.78 (0.56 - 1.08) | 0.75 (0.57 - 1.00) | 1.01 (0.81, 1.26) | 0.91 (0.77 - 1.06) |
| Alcohol use in first trimester |  |  |  |  |
| No alcohol | 1.00 | 1.00 | 1.00 | 1.00 |
| Less than 1 drink per week | 0.85 (0.52 - 1.31) | 1.06 (0.73 - 1.51) | 1.20 (0.89, 1.59) | 0.88 (0.71 - 1.08) |
| 1 drink per week | 0.95 (0.40 - 1.92) | 0.74 (0.31 - 1.49) | 1.04 (0.56, 1.77) | 0.68 (0.43 - 1.02) |
| 2+ drinks per week | 0.70 (0.43 - 1.08) | 0.78 (0.52 - 1.13) | 1.28 (0.97, 1.66) | 0.98 (0.80 - 1.20) |
| Alcohol use in rest of pregnancy |  |  |  |  |
| No alcohol | 1.00 | 1.00 | 1.00 | 1.00 |
| Less than 1 drink per week | 0.70 (0.42 - 1.11) | 0.71 (0.46 - 1.05) | 1.24 (0.92, 1.65) | 0.79 (0.64 - 0.97) |
| 1 drink per week | 1.05 (0.36 - 2.38) | 0.44 (0.11 - 1.18) | 1.46 (0.75, 2.61) | 0.84 (0.52 - 1.33) |
| 2+ drinks per week | 0.54 (0.16 - 1.30) | 0.49 (0.17 - 1.10) | 1.81 (1.11, 2.84) \* | 1.16 (0.78 - 1.69) |

\*p<.05; \*\*p<.01; \*\*\*p<.001; \*\*\*\*p<.0001; † each logistic regression modelled a pregnancy health variable on a birth outcome, and all were adjusted for maternal age, ethnicity, area deprivation, maternal education, labour force participation, parity, and pregnancy planning

Table 3. *Adjusted logistic regressions: maternal alcohol, weight, activity and nausea modelling birth outcomes*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | LBW: OR (95% CI)† | PTB: OR (95% CI)† | SGA: OR (95% CI)† | Caesarean: OR (95% CI)† |
| Pre-pregnancy BMI |  |  |  |  |  |
| < 18.5 Underweight |  | 1.18 (0.60 - 2.11) | 1.15 (0.61 - 2.00) | 1.23 (0.82, 1.79) | 0.67 (0.45 - 0.95) \* |
| 18.5 ≥ Normal < 25 |  | 1.00 | 1.00 | 1.00 | 1.00 |
| 25 ≥ Overweight < 30 |  | 1.42 (1.02 - 1.95) \* | 1.45 (1.10 - 1.92) \* | 1.04 (0.83, 1.30) | 1.46 (1.24 - 1.70) \*\*\*\* |
| ≥ 30 Obese |  | 1.65 (1.13 - 2.37) \* | 1.61 (1.17 - 2.20) \* | 0.89 (0.67, 1.17) | 1.81 (1.51 - 2.17) \*\*\*\* |
| Weight change during pregnancy |  |  |  |  |  |
| 0 (or weight loss) |  | 2.03 (1.14 - 3.42) \* | 1.91 (1.14 - 3.05) \*\* | 1.78 (1.16, 2.65) \*\* | 1.20 (0.85 - 1.69) |
| 1-5kg |  | 1.26 (0.84 - 1.86) | 1.31 (0.92 - 1.85) | 1.38 (1.05, 1.80) \* | 0.88 (0.71 - 1.10) |
| 6-10kg |  | 1.00 | 1.00 | 1.00 | 1.00 |
| 11-15kg |  | 0.79 (0.56 - 1.12) | 0.70 (0.51 - 0.95) \* | 0.77 (0.61, 0.97) \* | 1.20 (1.03 - 1.40) \* |
| 16-20kg |  | 0.41 (0.20 - 0.76) \*\* | 0.70 (0.43 - 1.08) | 0.45 (0.30, 0.66) \*\*\*\* | 1.25 (1.00 - 1.55) \* |
| >20kg |  | 1.22 (0.67 - 2.11) | 1.40 (0.86 - 2.20) | 0.83 (0.54, 1.24) | 1.55 (1.16 - 2.04) \* |
| Pre-pregnancy activity: ≥ 5 moderate or ≥ 2 vigorous |  |  |  |  |  |
| No |  | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes |  | 0.93 (0.72, 1.21) | 0.99 (0.79, 1.24) | 1.09 (0.91, 1.30) | 0.92 (0.81, 1.04) |
| First trimester activity: ≥ 5 moderate or ≥ 2 vigorous |  |  |  |  |  |
| No |  | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes |  | 0.97 (0.73, 1.29) | 0.98 (0.76, 1.24) | 1.14 (0.95, 1.37) | 0.89 (0.78, 1.02) |
| Rest of pregnancy activity: ≥ 5 moderate or ≥ 2 vigorous |  |  |  |  |  |
| No |  | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes |  | 0.82 (0.59, 1.11) | 0.81 (0.61, 1.06) | 1.08 (0.89, 1.32) | 0.74 (0.64, 0.86) \*\*\*\* |
| First trimester nausea |  |  |  |  |  |
| None |  | 1.00 | 1.00 | 1.00 | 1.00 |
| Mild |  | 0.82 (0.58, 1.15) | 0.84 (0.62, 1.15) | 1.04 (0.83, 1.32) | 0.97 (0.82, 1.15) |
| Moderate |  | 0.89 (0.62, 1.26) | 1.15 (0.85, 1.57) | 0.89 (0.69, 1.14) | 1.11 (0.94, 1.32) |
| Severe |  | 0.96 (0.67, 1.38) | 1.10 (0.80, 1.52) | 1.32 (1.04, 1.68) \* | 1.05 (0.87, 1.26) |
| Rest of pregnancy nausea |  |  |  |  |  |
| None |  | 1.00 | 1.00 | 1.00 | 1.00 |
| Mild |  | 1.29 (0.94, 1.74) | 1.26 (0.96, 1.63) | 1.35 (1.09, 1.66) \*\* | 1.14 (0.98, 1.33) |
| Moderate |  | 1.09 (0.71, 1.61) | 0.95 (0.65, 1.35) | 1.11 (0.83, 1.45) | 1.19 (0.98, 1.43) |
| Severe |  | 1.07 (0.57, 1.85) | 1.28 (0.77, 2.01) | 1.91 (1.35, 2.65) \*\*\* | 0.98 (0.73, 1.30) |

\*p<.05; \*\*p<.01; \*\*\*p<.001; \*\*\*\*p<.0001

† logistic regressions adjusted for maternal age, ethnicity, area deprivation, maternal education, labour force participation, parity, and pregnancy planning

Table 4. *Adjusted logistic regressions: number of health risk factors modelling birth outcomes*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Risk of Birth Outcome | | | | | | | |
| Number of Risk Factors | LBW: OR (95% CI)† | Number of Risk Factors | PTB: OR (95% CI)† | Number of Risk Factors | SGA: OR (95% CI)† | Number of Risk Factors | | Caesarean: OR (95% CI)† |
| 0 | 1.00 | 0 | 1.00 | 0 | 1.00 | 0 | | 1.00 |
| 1 | 1.51 (1.09, 2.08) \* | 1 | 1.25 (0.94, 1.65) | 1 | 1.72 (1.38, 2.15) \*\*\*\* | 1 | | 1.41 (0.99, 2.05) |
| 2 | 2.24 (1.40, 3.52) \*\*\* | 2 or 3 | 2.87 (1.89, 4.28) \*\*\*\* | 2 | 2.39 (1.60, 3.50) \*\*\*\* | 2 | | 2.03 (1.44, 2.92) \*\*\*\* |
| 3 or 4 | 3.86 (1.66, 8.11) \*\*\* |  |  | 3 | 6.24 (1.30, 23.24) \*\* | 3 | | 2.86 (2.01, 4.16) \*\*\*\* |
|  |  |  |  |  |  | 4 | | 4.56 (2.89, 7.28) \*\*\*\* |
| Risk factors | | | | | | | | |
| * *BMI overweight or obese* * *Weight loss/ no weight gain (pregnancy)* * *Continuing to smoke* * *Doctor diagnosed illness (pregnancy)* | | * *BMI overweight or obese* * *Weight loss/no weight gain (pregnancy)* * *Continuing to smoke* | | * *Weight loss/no weight gain (pregnancy)* * *Smoking (either before or during pregnancy)* * *More than 2+ alcoholic drinks (2nd and 3rd trimesters)* * *Pregnancy nausea (severe 1st trimester or mild or severe rest of pregnancy)* | | | * *BMI overweight or obese* * *Weight gain >11kg (pregnancy)* * *Doctor diagnosed illness (before pregnancy)* * *Lack of regular exercise (2nd and 3rd trimesters)* | |

\*p<.05; \*\*p<.01; \*\*\*p<.001; \*\*\*\*p<.0001

† logistic regressions adjusted for maternal age, ethnicity, area deprivation, maternal education, labour force participation, parity, and pregnancy planning

*Figure 1*. Overview: women at increased risk of adverse birth outcomes

* Women who continue to **smoke** and/or consume **alcohol** during pregnancy
* Women with a **doctor-diagnosed illness** (before or during pregnancy)
* Women with a pre-pregnancy BMI in the **overweight or obese** range
* Women who **fail to gain weight** during pregnancy
* Women with severe and/or persistent **nausea and vomiting** during pregnancy

***Women with >2 of these risk factors are at 2-6 times the risk of adverse birth outcomes***

1. 1007 (15%) had asthma, 335 (5%) had heart disease or high blood pressure, 944 (14%) had anaemia, 49 (1%) had diabetes [↑](#footnote-ref-1)
2. 551 (8%) had asthma, 127 (2%) had heart disease or high blood pressure, 559 (8%) had anaemia, 80 (1%) had diabetes [↑](#footnote-ref-2)
3. 24 (0.03%) had asthma, 154 (2%) had heart disease or high blood pressure, 317 (5%) had anaemia, 162 (2%) had diabetes [↑](#footnote-ref-3)
4. 134 (2.0%) of the sample had a sensory disability, 114 (1.7%) had a mobility/agility disability, 83 (1.2%) had a psychological or intellectual disability, 95 (1.4%) indicated a disability in some other area of functioning [↑](#footnote-ref-4)