Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.
eMethods.
The variables for developing the algorithm to achieve twin pairs included dob_yy, mager, mbstate_rec, restatus, mrace31, mrace6, mrace15, mbrate, mphisp_r, mracehisp, dmar, meduc, fagecomb, frace31, frace6, frace15, fbrate, fhisp_r, fracehisp, feduc, precare, previs, cig_0, cig_1, cig_2, cig_3, m_ht_in, bmi, pwgt_r, dwgt_r, wtgain, rf_pdiab, rf_gdiab, rf_phype, rf_gophype, rf_ehype, rf_infr, rf_fedrg, rf_artec, ip_gon, ip_syph, ip_chlam, ip_hepatb, ip_hepatc, mm_mtr, mm_plac, mm_rupt, mm_uhyst, mm_aicu, pay, dlmp_mm, dlmp_yy and oegest_comb.
Maternal smoking status was classified as “never smoke”, “smoke only before pregnancy” and “smoke during pregnancy with/without smoking before pregnancy”. The method of conception was classified as spontaneous, fertility-enhancing drugs for ovulation induction (OI) and/or intrauterine insemination (IUI) and assisted reproductive technology (e.g., in vitro fertilization (IVF), gamete intrafallopian transfer (GIFT), and zygote intrafallopian transfer (ZIFT)). Neonatal sex was classified as male-male, male-female and female-female.
The birthweight percentiles were calculated based on a subgroup population that met the following criteria: (1) no known congenital anomalies; (2) gestational age at birth between 24 weeks and 42 weeks; and (3) birthweight between 500 g and 6,000 g. Quantile regression models using cubic splines with 5 knots were used to calculate the 5th, 10th, 50th, 90th and 95th percentile cut points by gestational week and draw growth curves for the male and female twins (eTable 1 and eFigure 1 in the Supplement).
To ensure exact comparison between the IOM recommendations versus the optimal GWG ranges. The IOM recommendations were standardized for 36 weeks of gestation by dividing the ranges by 37 weeks and multiplying 36 weeks (16.3-23.8 kg for normal weight, 13.7-22.1 kg for overweight and 11.0-18.6 for obesity).
### eTable 1. Sex-Specific Birthweight Percentiles in Twins

| Weeks of gestation | Female | | Male | |
|--------------------|--------|--------|--------|--------|
|                    | n      | 5th    | 10th   | 50th   | 90th   | n      | 5th    | 10th   | 50th   | 90th   | 95th   |
| 24                 | 820    | 567    | 583    | 680    | 810    | 873    | 857    | 595    | 624    | 735    | 873    | 910    |
| 25                 | 1,127  | 551    | 600    | 750    | 897    | 960    | 1,109  | 571    | 638    | 804    | 960    | 100    |
| 26                 | 1,375  | 573    | 648    | 843    | 101    | 107    | 1,543  | 592    | 686    | 899    | 107    | 113    |
| 27                 | 1,831  | 630    | 724    | 956    | 114    | 121    | 1,895  | 652    | 765    | 101    | 121    | 128    |
| 28                 | 2,411  | 716    | 823    | 108    | 130    | 137    | 2,434  | 743    | 868    | 115    | 138    | 145    |
| 29                 | 2,844  | 822    | 939    | 123    | 147    | 155    | 3,016  | 854    | 988    | 130    | 156    | 164    |
| 30                 | 3,911  | 952    | 107    | 138    | 166    | 175    | 4,210  | 992    | 116    | 146    | 175    | 185    |
| 31                 | 5,665  | 109    | 121    | 155    | 186    | 196    | 5,855  | 114    | 128    | 164    | 196    | 206    |
| 32                 | 9,592  | 124    | 137    | 172    | 206    | 217    | 9,564  | 130    | 144    | 182    | 217    | 228    |
| 33                 | 13,15  | 142    | 154    | 190    | 226    | 238    | 13,17  | 149    | 161    | 201    | 238    | 250    |
| 34                 | 23,36  | 158    | 170    | 208    | 247    | 259    | 23,53  | 166    | 178    | 219    | 260    | 272    |
| 35                 | 30,14  | 175    | 187    | 226    | 267    | 280    | 30,64  | 183    | 195    | 237    | 280    | 293    |
| 36                 | 48,14  | 192    | 204    | 244    | 286    | 300    | 47,75  | 201    | 213    | 255    | 300    | 314    |
| 37                 | 59,11  | 207    | 218    | 260    | 306    | 320    | 58,89  | 214    | 227    | 272    | 319    | 333    |
| 38                 | 40,71  | 223    | 234    | 276    | 322    | 336    | 41,40  | 230    | 243    | 288    | 335    | 350    |
| 39                 | 3,885  | 234    | 246    | 291    | 338    | 352    | 4,030  | 240    | 254    | 302    | 350    | 365    |
| 40                 | 834    | 245    | 258    | 304    | 350    | 365    | 820    | 249    | 266    | 315    | 362    | 377    |
| 41                 | 117    | 253    | 268    | 316    | 361    | 374    | 119    | 256    | 275    | 325    | 372    | 386    |
| 42                 | 35     | 257    | 274    | 326    | 369    | 382    | 35     | 256    | 279    | 333    | 378    | 393    |

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**eTable 2.** Characteristics and Outcomes of Main Study Sample (n=200,810)

| Characteristics or outcomes | Total (200,810) | Underweight (n=5,333) | Normal weight (n=84,617) | Overweight (n=51,796) | Obesity I (n=30,477) | Obesity II (n=16,191) | Obesity III (n=12,396) |
|----------------------------|----------------|-----------------------|--------------------------|-----------------------|-----------------------|------------------------|------------------------|
| Maternal age               | 30.4±5.5       | 29.0±5.8              | 30.7±5.5                 | 30.5±5.6              | 30.1±5.6              | 29.8±5.5               | 29.4±5.3               |
| Race and ethnicity         |                |                       |                          |                       |                       |                        |                        |
| White                      | 149,732 (74.6) | 3,803 (71.3)          | 66,194 (78.2)            | 38,678 (74.7)         | 21,811 (71.6)         | 11,297 (69.8)          | 7,949 (64.1)           |
| Black                      | 36,423 (18.1)  | 668 (12.5)            | 10,263 (12.1)            | 9,750 (18.8)          | 7,242 (23.8)          | 4,358 (26.9)           | 4,142 (33.4)           |
| American Indian or Alaskan Native | 1,624 (0.8) | 25 (0.5)              | 470 (0.6)                | 467 (0.9)             | 327 (1.1)             | 182 (1.1)              | 153 (1.2)              |
| Asian or Pacific Islander | 13,031 (6.5)  | 837 (15.7)            | 7,690 (9.1)              | 2,901 (5.6)           | 1,097 (3.6)           | 354 (2.2)              | 152 (1.2)              |
| Smoking status             |                |                       |                          |                       |                       |                        |                        |
| Never smoke                | 181,474 (90.4) | 4,552 (85.4)          | 77,586 (91.7)            | 47,009 (90.8)         | 27,181 (89.2)         | 14,305 (88.4)          | 10,841 (87.5)          |
| Only smoke before pregnancy | 4,768 (2.4)   | 119 (2.2)             | 1,656 (2.0)              | 1,197 (2.3)           | 890 (2.9)             | 491 (3.0)              | 415 (3.4)              |
| Only smoke during pregnancy | 198 (0.1)     | 10 (0.2)              | 65 (0.1)                 | 52 (0.1)              | 32 (0.1)              | 17 (0.1)               | 22 (0.2)               |
| Smoke before and during pregnancy | 12,944 (6.5) | 600 (11.3)            | 4,711 (5.6)              | 3,178 (6.1)           | 2,159 (7.1)           | 1,261 (7.8)            | 1,035 (8.4)            |
| Unknown          | 1,426 (0.7) | 52 (1.0) | 599 (0.7) | 360 (0.7) | 215 (0.7) | 117 (0.7) | 83 (0.7) |
|------------------|-------------|----------|-----------|-----------|-----------|-----------|---------|
| Marital status   |             |          |           |           |           |           |         |
| Married          | 132,430 (66.0) | 3,362 (63) | 60,819 (71.9) | 33,995 (65.6) | 18,509 (60.7) | 9,302 (57.5) | 6,443 (52.0) |
| Unmarried        | 62,631 (31.2) | 1,821 (34.2) | 21,280 (25.2) | 16,203 (31.3) | 11,109 (36.5) | 6,526 (40.3) | 5,692 (45.9) |
| Unknown          | 5,749 (2.9) | 150 (2.8) | 2,518 (3.0) | 1,598 (3.1) | 859 (2.8) | 363 (2.2) | 261 (2.1) |
| Nulliparity      |             |          |           |           |           |           |         |
| No               | 137,409 (68.4) | 3,225 (60.5) | 53,827 (63.6) | 36,423 (70.3) | 22,602 (74.2) | 11,984 (74) | 9,348 (75.4) |
| Yes              | 61,748 (30.8) | 2,051 (38.5) | 30,122 (35.6) | 14,946 (28.9) | 7,634 (25.1) | 4,055 (25) | 2,940 (23.7) |
| Unknown          | 1,653 (0.8) | 57 (1.1) | 668 (0.8) | 427 (0.8) | 241 (0.8) | 152 (0.9) | 108 (0.9) |
| Method of conception |         |          |           |           |           |           |         |
| Spontaneous      | 171,705 (85.5) | 4,653 (87.3) | 69,956 (82.7) | 44,432 (85.8) | 26,782 (87.9) | 14,469 (89.4) | 11,413 (92.1) |
| Fertility-enhancing drugs for OI and/or IUI | 8,431 (4.2) | 173 (3.2) | 4,049 (4.8) | 2,065 (4) | 1,092 (3.6) | 615 (3.8) | 437 (3.5) |
| Assisted reproductive technology | 18,737 (9.3) | 476 (8.9) | 9,620 (11.4) | 4,822 (9.3) | 2,345 (7.7) | 992 (6.1) | 482 (3.9) |
| Unknown          | 1,937 (1.0) | 31 (0.6) | 992 (1.2) | 477 (0.9) | 258 (0.9) | 115 (0.7) | 64 (0.5) |
| Neonatal sex combination |         |          |           |           |           |           |         |
| Male-Male        | 64,537 (32.1) | 1,807 (33.9) | 27,852 (32.9) | 16,797 (32.4) | 9,559 (31.4) | 4,861 (30.0) | 3,661 (29.5) |
|                         | Female-female | Male-female | Pre-pregnancy diabetes | GDM | Pre-pregnancy hypertension | GHDs | PTB <36 weeks |
|-------------------------|---------------|-------------|------------------------|-----|---------------------------|------|--------------|
|                         | 63,770 (31.8) | 72,503 (36.1)| 199,006 (99.1)         | 184,783 (92.0) | 195,821 (97.5) | 176,824 (88.1) | 122,982 (61.2) |
|                         | 1,819 (34.1)  | 1,707 (32)  | 5,315 (99.7)           | 5,102 (95.7)  | 5,304 (99.5)   | 4,949 (92.8)   | 2,994 (56.1)   |
|                         | 27,280 (32.2) | 29,485 (36.1)| 84,271 (99.6)          | 79,911 (94.4) | 83,772 (99.0) | 76,602 (90.5) | 52,197 (61.7)  |
|                         | 16,378 (31.6) | 18,621 (36.0)| 51,424 (99.3)          | 47,669 (92.0) | 50,836 (98.2) | 45,607 (88.0) | 32,063 (61.9)  |
|                         | 9,633 (31.6)  | 11,285 (37.0)| 30,084 (98.7)          | 27,287 (89.5) | 29,382 (96.4) | 26,148 (85.8) | 18,517 (60.8)  |
|                         | 4,935 (30.5)  | 6,395 (39.5) | 15,851 (97.9)          | 14,173 (87.5) | 15,295 (94.5) | 13,540 (83.6) | 9,749 (60.8)   |
|                         | 3,725 (40.4)  | 5,010 (40.4) | 12,061 (97.3)          | 10,641 (85.8) | 11,232 (90.6) | 9,978 (80.5)  | 7,462 (60.2)   |
| Pre-pregnancy diabetes  |               |             |                        |     |                           |      |              |
| No                      |               |             |                        |     |                           |      |              |
| Yes                     | 1,804 (0.9)   | 18 (0.3)    | 346 (0.4)              | 372 (0.7)   | 393 (1.3)      | 340 (2.1)      | 335 (2.7)      |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                         | 16,027 (8.0)  | 231 (4.3)   | 4,706 (5.6)            | 4,127 (8.0) | 3,190 (10.5)   | 2,018 (12.5)   | 1,755 (14.2)   |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
| Pre-pregnancy hypertension |              |             |                        |     |                           |      |              |
| No                      |               |             |                        |     |                           |      |              |
| Yes                     | 4,989 (2.5)   | 29 (0.5)    | 845 (1.0)              | 960 (1.9)   | 1,095 (3.6)   | 896 (5.5)      | 1,164 (9.4)    |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
| GDM                     |               |             |                        |     |                           |      |              |
| No                      |               |             |                        |     |                           |      |              |
| Yes                     | 23,986 (11.9) | 384 (7.2)   | 8,015 (9.5)            | 6,189 (12.0)| 4,329 (14.2)  | 2,651 (16.4)   | 2,418 (19.5)   |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
| PTB <36 weeks           |               |             |                        |     |                           |      |              |
| No                      |               |             |                        |     |                           |      |              |
| Yes                     | 77,828 (38.8) | 2,339 (43.9)| 32,420 (38.3)          | 19,733 (38.1)| 11,960 (39.2) | 6,442 (39.8)  | 4,934 (39.8)   |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                         |               |             |                        |     |                           |      |              |
|                  | SGA (calculated as per newborn) | LGA (calculated as per newborn) |
|------------------|---------------------------------|---------------------------------|
|                  | No                              | Yes                             |
|                  | 361,386 (90.0)                  | 40,234 (10.0)                   |
|                  | 8,885 (83.3)                    | 1,781 (16.7)                    |
|                  | 150,876 (89.2)                  | 18,358 (10.9)                   |
|                  | 93,723 (90.5)                   | 9,869 (9.5)                     |
|                  | 55,512 (91.1)                   | 5,442 (8.9)                     |
|                  | 29,581 (91.4)                   | 2,801 (8.7)                     |
|                  | 22,809 (92.0)                   | 1,983 (8.0)                     |
|                  | Yes                             | No                              |
|                  | 362,171 (90.2)                  | 39,449 (9.8)                    |
|                  | 10,205 (95.7)                   | 4,61 (4.3)                      |
|                  | 156,241 (92.3)                  | 12,993 (7.7)                    |
|                  | 92,975 (89.8)                   | 10,617 (10.3)                   |
|                  | 53,757 (88.2)                   | 7,197 (11.8)                    |
|                  | 27,974 (86.4)                   | 4,408 (13.6)                    |
|                  | 21,019 (84.8)                   | 3,773 (15.2)                    |

OI, ovulation induction; IUI, intrauterine insemination; GDM, gestational diabetes mellitus; GHDs, gestational hypertensive disorders; PTB, preterm birth; SGA, small for gestational age; LGA, large for gestational age.
### Table 3. Characteristics and Outcomes of Validation Sample (n=49,275)

| Characteristics or outcomes | Total (49,275) | Underweight (n=19,016) | Normal weight (n=13,178) | Overweight (n=7,994) | Obesity I (n=4,429) | Obesity II (n=3,490) |
|-----------------------------|---------------|------------------------|--------------------------|---------------------|---------------------|---------------------|
| **Maternal age**            | 30.5±5.5      | 29.1±5.8               | 30.8±5.5                 | 30.3±5.5            | 29.9±5.4            | 29.7±5.1            |
| **Race and ethnicity**      |               |                        |                          |                     |                     |                     |
| White                       | 36,036 (73.1) | 801 (68.6)             | 14,609 (76.8)            | 9,662 (73.3)        | 5,670 (70.9)        | 3,015 (68.1)        |
| Black                       | 9,653 (19.6)  | 189 (16.2)             | 2,526 (13.3)             | 2,596 (19.7)        | 1,944 (24.3)        | 1,264 (28.5)        |
| American Indian or Alaskan Native | 388 (0.8) | 6 (0.5)                | 105 (0.6)                | 109 (0.8)           | 76 (1)              | 51 (1.2)            |
| Asian or Pacific Islander   | 3,198 (6.5)   | 172 (14.7)             | 1,776 (9.3)              | 811 (6.2)           | 304 (3.8)           | 99 (2.2)            |
| **Smoking status**          |               |                        |                          |                     |                     |                     |
| Never smoke                 | 45,129 (91.6) | 1,027 (87.9)           | 17,640 (92.8)            | 12,110 (91.9)       | 7,245 (90.6)        | 3,979 (89.8)        |
| Only smoke before pregnancy | 1,009 (2.1)   | 22 (1.9)               | 296 (1.6)                | 262 (2)             | 199 (2.5)           | 133 (3.0)           |
| Only smoke during pregnancy | 47 (0.1)      | 1 (0.1)                | 15 (0.1)                 | 13 (0.1)            | 11 (0.1)            | 3 (0.1)             |
| Smoke before and during pregnancy | 2,914 (5.9) | 111 (9.5)             | 1,004 (5.3)              | 747 (5.7)           | 508 (6.4)           | 297 (6.7)           |
| Unknown                     | 176 (0.4)     | 7 (0.6)                | 61 (0.3)                 | 46 (0.4)            | 31 (0.4)            | 17 (0.4)            |
| **Marital status**          |               |                        |                          |                     |                     |                     |
| Married                     | 28,683 (58.2) | 592 (50.7)             | 12,027 (63.3)            | 7,738 (58.7)        | 4,392 (54.9)        | 2,244 (50.7)        |
| Unmarried                   | 1,5065 (30.6) | 413 (35.4)             | 4,710 (24.8)             | 3,906 (29.6)        | 2,769 (34.6)        | 1,745 (39.4)        |
| Unknown                     | 5,527 (11.2)  | 163 (14.0)             | 2,279 (12.0)             | 1,534 (11.6)        | 833 (10.4)          | 440 (9.9)           |
| **Nulliparity**             |               |                        |                          |                     |                     |                     |
| No                          | 34,758 (70.5) | 731 (62.6)             | 12,593 (66.2)            | 9,393 (71.3)        | 5,976 (74.8)        | 3,371 (76.1)        |
| Yes                         | 14,298 (29)   | 429 (36.7)             | 6,333 (33.3)             | 3,735 (28.3)        | 1,976 (24.7)        | 1,038 (23.4)        |
| Unknown                     | 219 (0.4)     | 8 (0.7)                | 90 (0.5)                 | 50 (0.4)            | 42 (0.5)            | 20 (0.5)            |
| **Method of conception**    |               |                        |                          |                     |                     |                     |
| Spontaneous                 | 43,009 (87.3) | 1,038 (88.9)           | 16,154 (85.0)            | 11,487 (87.2)       | 7,095 (88.8)        | 4,009 (90.5)        |
| Fertility-enhancing drugs for OI and/or IUI | 1,877 (3.8) | 36 (3.1)             | 799 (4.2)               | 509 (3.9)           | 284 (3.6)           | 142 (3.2)           |
| Assisted reproductive technology | 4,119 (8.4) | 90 (7.7)              | 1,959 (10.3)            | 1,096 (8.3)         | 579 (7.2)           | 257 (5.8)           |
| Unknown                     | 270 (0.6)     | 4 (0.3)                | 104 (0.6)                | 86 (0.7)            | 36 (0.5)            | 21 (0.5)            |
| **Neonatal sex combination**|               |                        |                          |                     |                     |                     |
| Male-Male                   | 15,928 (32.3) | 416 (35.6)             | 6,307 (33.2)             | 4,233 (32.1)        | 2,574 (32.2)        | 1,361 (30.7)        |
| Female-female               | 15,828 (32.1) | 425 (36.4)             | 6,261 (32.9)             | 4,284 (32.5)        | 2,487 (31.1)        | 1,337 (30.2)        |
|                          | Male-female | Pre-pregnancy diabetes | GDM | Pre-pregnancy hypertension | GHDs | PTB <36 weeks | SGA (calculated as per newborn) | LGA (calculated as per newborn) |
|--------------------------|-------------|------------------------|-----|---------------------------|------|--------------|--------------------------------|--------------------------------|
|                          | 17,519 (35.6) | 327 (28) | 6,448 (33.9) | 4,661 (35.4) | 2,933 (36.7) | 1,731 (39.1) | 1,419 (40.7) | 48,826 (99.1) | 1,166 (99.8) | 18,940 (99.6) | 13,075 (99.2) | 7,899 (98.8) | 4,351 (98.2) | 3,395 (97.3) | 449 (0.9) | 2 (0.2) | 76 (0.4) | 103 (0.8) | 95 (1.2) | 78 (1.8) | 95 (2.7) | 44,727 (90.8) | 1,111 (95.1) | 17,740 (93.3) | 12,025 (91.3) | 7,081 (88.6) | 3,824 (86.3) | 2,946 (84.4) | 4,548 (9.2) | 57 (4.9) | 1276 (6.7) | 1153 (8.8) | 913 (11.4) | 605 (13.7) | 544 (15.6) | 47,807 (97.0) | 1,156 (99.0) | 18,785 (98.8) | 12,913 (98.0) | 7,688 (96.2) | 4,156 (93.8) | 3,109 (89.1) | 1,468 (3.0) | 12 (1.0) | 231 (1.2) | 265 (2.0) | 306 (3.8) | 273 (6.2) | 381 (10.9) | 42,542 (86.3) | 1,064 (91.1) | 16,960 (89.2) | 11,466 (87) | 6,688 (83.7) | 3,602 (81.3) | 2,762 (79.1) | 6,733 (13.7) | 104 (8.9) | 2,056 (10.8) | 1,712 (13) | 1,306 (16.3) | 827 (18.7) | 728 (20.9) | 29,943 (60.8) | 611 (52.3) | 11,706 (61.6) | 8,110 (61.5) | 4,776 (59.7) | 2,646 (59.7) | 2,094 (60.0) | 19,332 (39.2) | 557 (47.7) | 7,310 (38.4) | 5,068 (38.5) | 3,218 (40.3) | 1,783 (40.3) | 1,396 (40.0) | 88,881 (90.2) | 1,990 (85.2) | 33,831 (89) | 23,910 (90.7) | 14,555 (91.0) | 8,122 (91.7) | 6,473 (92.7) | 9,669 (9.8) | 346 (14.8) | 4201 (11.1) | 2,446 (9.3) | 1,433 (9.0) | 736 (8.3) | 507 (7.3) | 88,682 (90.0) | 2,246 (96.2) | 35,048 (92.2) | 23,671 (89.8) | 14,130 (88.4) | 7,668 (86.6) | 5,919 (84.8) | 9,868 (10.0) | 90 (3.9) | 2,984 (7.9) | 2,685 (10.2) | 1,858 (11.6) | 1,190 (13.4) | 1,061 (15.2) |

OI, ovulation induction; IUI, intrauterine insemination; GDM, gestational diabetes mellitus; GHDs, gestational hypertensive disorders; PTB, preterm birth; SGA, small for gestational age; LGA, large for gestational age.
**Table 4.** Comparison Between the Main Sample and Validation Sample

| Characteristics or outcomes | Main Sample (n= 200,810) | Validation Sample (n= 49,275) | P-value |
|-----------------------------|--------------------------|-------------------------------|---------|
| Maternal age                | 30.4±5.5                 | 30.5±5.5                      | <0.001  |
| BMI category                |                          |                               |         |
| Underweight                 | 5,333 (2.7)              | 1,168 (2.4)                   | <0.001  |
| Normal-weight               | 84,617 (42.1)            | 19,016 (38.6)                 |         |
| Overweight                  | 51,796 (25.8)            | 13,178 (26.7)                 |         |
| Obese Class I               | 30,477 (15.2)            | 7,994 (16.2)                  |         |
| Obese Class II              | 16,191 (8.1)             | 4,429 (9.0)                   |         |
| Obese Class III             | 12,396 (6.2)             | 3,490 (7.1)                   |         |
| Race and ethnicity          |                          |                               |         |
| White                       | 149,732 (74.6)           | 36,036 (73.1)                 | <0.001  |
| Black                       | 36,423 (18.1)            | 9,653 (19.6)                  |         |
| American Indian or Alaskan Native | 1,624 (0.8) | 388 (0.8) |         |
| Asian or Pacific Islander   | 13,031 (6.5)             | 3,198 (6.5)                   |         |
| Smoking status              |                          |                               |         |
| Never smoke                 | 181,474 (90.4)           | 45,129 (91.6)                 | <0.001  |
| Only smoke before pregnancy | 4,768 (2.4)              | 1,009 (2.1)                   |         |
| Only smoke during pregnancy | 198 (0.1)                | 47 (0.1)                      |         |
| Smoke before and during pregnancy | 12,944 (6.5) | 2,914 (5.9) |         |
| Unknown                     |                          |                               |         |
| Marital status              |                          |                               | <0.001  |
| Married                     | 132,430 (66.0)           | 28,683 (58.2)                 |         |
| Unmarried                   | 62,631 (31.2)            | 15,065 (30.6)                 |         |
| Unknown                     | 5,749 (2.9)              | 5,527 (11.2)                  |         |
| Nulliparity                 |                          |                               | <0.001  |
| No                          | 137,409 (68.4)           | 34,758 (70.5)                 |         |
| Yes                         | 61,748 (30.8)            | 14,298 (29.0)                 |         |
| Unknown                     | 1,653 (0.8)              | 219 (0.5)                     |         |
| Method of conception        |                          |                               | <0.001  |
| Spontaneous                 | 171,705 (85.5)           | 43,009 (87.3)                 |         |
| Fertility-enhancing drugs for OI and/or IUI | 8,431 (4.2) | 1,877 (3.8) |         |
| Assisted reproductive technology | 18,737 (9.3) | 4,119 (8.4) |         |
| Unknown                     | 1,937 (1.0)              | 270 (0.6)                     |         |
| Neonatal sex combination    |                          |                               |         |
| Male-Male                   | 64,537 (32.1)            | 15,928 (32.3)                 | 0.066   |
| Female-female               | 63,770 (31.8)            | 15,828 (32.1)                 |         |
| Male-female                 | 72,503 (36.1)            | 17,519 (35.6)                 |         |
| Pre-pregnancy diabetes      | 1,804 (0.9)              | 449 (0.9)                     | 0.787   |
| GDM                         | 16,027 (8.0)             | 4,548 (9.2)                   | <0.001  |
| Pre-pregnancy hypertension  | 4,989 (2.5)              | 1,468 (3.0)                   | <0.001  |
| GHDS                        | 23,986 (11.9)            | 6,733 (13.7)                  | <0.001  |
| PTB <36 weeks               | 77,828 (38.8)            | 19,332 (39.2)                 | 0.052   |
| PTB <34 weeks               | 34,859 (17.4)            | 8,464 (17.2)                  | 0.338   |
| PTB <32 weeks               | 16,637 (8.3)             | 3,954 (8.0)                   | 0.059   |

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| Condition                  | Value 1   | Value 2   | P-Value |
|---------------------------|-----------|-----------|---------|
| SGA (calculated as per newborn) | 40,234 (10.0) | 9,669 (9.8) | 0.052   |
| LGA (calculated as per newborn) | 39,449 (9.8) | 9,868 (10.0) | 0.072   |
**eTable 5.** Incidence of Outcomes by Standardized GWG Category and BMI Category (Used as Main Study Sample)

| Standardized GWG (kg) | Composite Outcome | PTB<36 weeks | GHDs | SGA | LGA |
|-----------------------|-------------------|--------------|------|-----|-----|
| Underweight (n=5,333) |                   |              |      |     |     |
| ≥30.0                 | 287 (63.2)        | 118 (52.0)   | 35 (15.4) | 49 (10.8) | 44 (9.7) |
| ≥25.0                 | 334 (57.8)        | 119 (41.2)   | 35 (12.1) | 59 (10.2) | 55 (9.5) |
| 17.5-29.9             | 4987 (64.7)       | 1983 (51.5)  | 215 (5.6) | 1342 (17.4) | 548 (4.0) |
| ≥10.0                 | 7945 (58.1)       | 3042 (44.5)  | 363 (5.3) | 2149 (15.7) | 548 (4.0) |
| 5.0-7.4               | 2393 (69.0)       | 991 (57.2)   | 77 (4.4) | 637 (18.4) | 138 (4.0) |
| 2.5-4.9               | 1091 (72.3)       | 460 (60.9)   | 48 (6.4) | 284 (18.8) | 48 (3.2) |
| 0-2.4                 | 743 (70.4)        | 304 (57.6)   | 37 (7.0) | 160 (15.2) | 67 (6.3) |
| Normal-weight (n=84,617) |              |              |      |     |     |
| ≥30.0                 | 287 (63.2)        | 118 (52.0)   | 35 (15.4) | 49 (10.8) | 44 (9.7) |
| ≥25.0                 | 334 (57.8)        | 119 (41.2)   | 35 (12.1) | 59 (10.2) | 55 (9.5) |
| 17.5-29.9             | 4987 (64.7)       | 1983 (51.5)  | 215 (5.6) | 1342 (17.4) | 548 (4.0) |
| ≥10.0                 | 7945 (58.1)       | 3042 (44.5)  | 363 (5.3) | 2149 (15.7) | 548 (4.0) |
| 5.0-7.4               | 2393 (69.0)       | 991 (57.2)   | 77 (4.4) | 637 (18.4) | 138 (4.0) |
| 2.5-4.9               | 1091 (72.3)       | 460 (60.9)   | 48 (6.4) | 284 (18.8) | 48 (3.2) |
| 0-2.4                 | 743 (70.4)        | 304 (57.6)   | 37 (7.0) | 160 (15.2) | 67 (6.3) |
| Range     | 32.5-34.9 | 35.0-37.4 | 37.5-39.9 | ≥40.0 | Overweight (n=51,796) | Obese Class I (n=30,477) |
|-----------|-----------|-----------|-----------|-------|-----------------------|--------------------------|
|           | 1300 (60.1) | 797 (69.3) | 442 (65.6) | 401 (77.1) | 1659 (67.5) | 2085 (62.1) |
|           | 424 (39.2)  | 265 (46.1) | 146 (43.3) | 161 (61.9) | 669 (54.4)  | 813 (48.4)  |
|           | 219 (20.3)  | 145 (25.2) | 89 (26.4)  | 71 (27.3)  | 94 (7.7)    | 128 (7.6)   |
|           | 130 (6.0)   | 73 (6.4)   | 40 (5.9)   | 37 (7.1)   | 430 (17.5)  | 452 (13.5)  |
|           | 381 (17.6)  | 228 (19.8) | 117 (17.4) | 91 (17.5)  | 117 (4.8)   | 206 (6.1)   |
|           | 35.0-37.4   | 797 (69.3) | 265 (46.1) | 146 (43.3) | 401 (77.1)  | 1659 (67.5) |
|           | 219 (20.3)  | 145 (25.2) | 89 (26.4)  | 71 (27.3)  | 94 (7.7)    | 128 (7.6)   |
|           | 130 (6.0)   | 73 (6.4)   | 40 (5.9)   | 37 (7.1)   | 430 (17.5)  | 452 (13.5)  |
|           | 381 (17.6)  | 228 (19.8) | 117 (17.4) | 91 (17.5)  | 117 (4.8)   | 206 (6.1)   |
| ≥40.0     | 401 (77.1)  | 161 (61.9) | 71 (27.3)  | 37 (7.1)   | 91 (17.5)   | 91 (17.5)   |
| Overweight (n=51,796) |           |           |           |       |               |             |
| 0-2.4     | 1659 (67.5) | 669 (54.4) | 94 (7.7)  | 430 (17.5) | 117 (4.8)   | 206 (6.1)   |
| 2.5-4.9   | 1546 (63.8) | 607 (50.1) | 81 (6.7)  | 370 (15.3) | 125 (5.2)   | 191 (7.2)   |
| 5.0-7.4   | 2667 (59.9) | 1022 (45.9)| 177 (7.9) | 637 (14.3) | 257 (5.8)   | 310 (10.2)  |
| 7.5-9.9   | 4492 (55.6) | 1686 (41.8)| 301 (7.5) | 1054 (13.1)| 473 (5.9)   | 804 (8.4)   |
| 10.0-12.4 | 5819 (54.5) | 2151 (40.3)| 431 (8.1) | 1211 (11.4)| 712 (6.7)   | 1713 (11.0) |
| 12.5-14.9 | 7303 (54.7) | 2709 (40.6)| 621 (9.3) | 1417 (10.6)| 1014 (7.6)  | 2229 (8.4)  |
| 15.0-17.4 | 7239 (50.5) | 2419 (33.8)| 758 (10.6)| 1305 (9.1) | 1338 (9.3)  | 2492 (9.7)  |
| 17.5-19.9 | 6824 (51.1) | 2240 (33.6)| 740 (11.1)| 1085 (8.1) | 1459 (10.9) | 2681 (10.0) |
| 20.0-22.4 | 5869 (53.3) | 1873 (34.1)| 792 (14.4)| 815 (7.4)  | 1370 (12.5) | 2681 (10.0) |
| 22.5-24.9 | 4471 (53.9) | 1379 (33.2)| 674 (16.3)| 581 (7.0)  | 1132 (13.7) | 1854 (10.0) |
| 25.0-27.4 | 3249 (57.0) | 1026 (36.0)| 493 (17.3)| 364 (6.4)  | 889 (15.6)  | 1854 (10.0) |
| 27.5-29.9 | 2195 (60.1) | 741 (40.6) | 328 (18.0)| 238 (6.5)  | 591 (16.2)  | 1854 (10.0) |
| 30.0-32.4 | 1483 (61.8) | 454 (37.8) | 249 (20.8)| 156 (6.5)  | 433 (18.0)  | 1854 (10.0) |
| 32.5-34.9 | 918 (62.3)  | 282 (38.3) | 179 (24.3)| 82 (5.6)   | 291 (19.7)  | 1854 (10.0) |
| 35.0-37.4 | 628 (67.8)  | 215 (46.4) | 116 (25.1)| 51 (5.5)   | 195 (21.1)  | 1854 (10.0) |
| 37.5-39.9 | 368 (67.2)  | 115 (42.0) | 72 (26.3) | 33 (6.0)   | 123 (22.5)  | 1854 (10.0) |
| ≥40.0     | 385 (78.9)  | 145 (59.4) | 83 (34.0) | 40 (8.2)   | 98 (20.1)   | 1854 (10.0) |

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| BMI Category | Obese Class II (n=16,191) | Obese Class III (n=12,396) |
|--------------|---------------------------|---------------------------|
| 20.0-22.4    | 2853 (57.5)               | 2106 (58.1)               |
|              | 902 (36.4)                | 635 (35.0)                |
|              | 430 (17.4)                | 347 (19.1)                |
|              | 362 (7.3)                 | 258 (7.1)                 |
|              | 781 (15.8)                | 567 (15.6)                |
| 22.5-24.9    | 1491 (60.3)               | 1050 (66.2)               |
|              | 470 (38.0)                | 339 (42.8)                |
|              | 259 (21.0)                | 184 (23.2)                |
|              | 147 (6.0)                 | 100 (6.3)                 |
|              | 429 (17.4)                | 282 (17.8)                |
| 25.0-27.4    | 680 (63.4)                | 216 (40.3)                |
|              | 115 (21.5)                | 53 (4.9)                  |
|              | 52 (7.4)                  | 195 (18.2)                |
|              | 150 (21.3)                |                             |
| 27.5-29.9    | 474 (67.1)                | 149 (42.2)                |
|              | 85 (24.1)                 |                             |
|              | 52 (7.4)                  |                             |
|              | 150 (21.3)                |                             |
| 30.0-32.4    | 294 (67.1)                | 149 (42.2)                |
|              | 85 (24.1)                 |                             |
|              | 52 (7.4)                  |                             |
|              | 150 (21.3)                |                             |
| 32.5-34.9    | 227 (79.9)                | 88 (62.0)                 |
|              | 40 (28.2)                 |                             |
|              | 15 (5.3)                  |                             |
|              | 48 (16.9)                 |                             |
| ≥35.0        | 1829 (62.1)               | 708 (48.1)                |
|              | 158 (10.7)                |                             |
|              | 327 (11.1)                |                             |
|              | 265 (9.0)                 |                             |
| 2.5-4.9      | 1312 (59.9)               | 481 (43.9)                |
|              | 120 (11.0)                |                             |
|              | 259 (11.8)                |                             |
|              | 175 (8.0)                 |                             |
| 5.0-7.4      | 1672 (57.5)               | 601 (41.4)                |
|              | 194 (13.4)                |                             |
|              | 277 (9.5)                 |                             |
|              | 282 (9.7)                 |                             |
| 7.5-9.9      | 2207 (56.8)               | 760 (39.1)                |
|              | 265 (13.6)                |                             |
|              | 373 (9.6)                 |                             |
|              | 447 (11.5)                |                             |
| 10.0-12.4    | 2223 (57.8)               | 737 (38.4)                |
|              | 297 (15.5)                |                             |
|              | 367 (9.6)                 |                             |
|              | 450 (11.7)                |                             |
| 12.5-14.9    | 2390 (60.5)               | 790 (40.0)                |
|              | 337 (17.1)                |                             |
|              | 320 (8.1)                 |                             |
|              | 569 (14.4)                |                             |
| 15.0-17.4    | 1959 (55.6)               | 611 (34.7)                |
|              | 301 (17.1)                |                             |
|              | 259 (7.4)                 |                             |
|              | 500 (14.2)                |                             |
| 17.5-19.9    | 1538 (58.2)               | 457 (34.6)                |
|              | 258 (19.5)                |                             |
|              | 191 (7.2)                 |                             |
|              | 458 (17.3)                |                             |
| 20.0-22.4    | 1232 (60.2)               | 377 (36.8)                |
|              | 221 (21.6)                |                             |
|              | 125 (6.1)                 |                             |
|              | 375 (18.3)                |                             |
| 22.5-24.9    | 934 (62.4)                | 299 (39.9)                |
|              | 152 (20.3)                |                             |
|              | 95 (6.3)                  |                             |
|              | 282 (18.8)                |                             |
| 25.0-27.4    | 651 (64.3)                | 197 (38.9)                |
|              | 103 (20.4)                |                             |
|              | 80 (7.9)                  |                             |
|              | 209 (20.7)                |                             |
| 27.5-29.9    | 450 (65.4)                | 140 (40.7)                |
|              | 86 (25.0)                 |                             |
|              | 53 (7.7)                  |                             |
|              | 124 (18.0)                |                             |
| 30.0-32.4    | 326 (66.8)                | 105 (43.0)                |
|              | 59 (24.2)                 |                             |
|              | 28 (5.7)                  |                             |
|              | 104 (21.3)                |                             |
| 32.5-34.9    | 193 (67.0)                | 60 (41.7)                 |
|              | 41 (28.5)                 |                             |
|              | 17 (5.9)                  |                             |
|              | 69 (24.0)                 |                             |
| ≥35.0        | 319 (68.2)                | 119 (50.9)                |
|              | 59 (25.2)                 |                             |
|              | 30 (6.4)                  |                             |
|              | 99 (21.2)                 |                             |

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| Weight Range | Count (%) | Count (%) | Count (%) | Count (%) | Count (%) |
|--------------|-----------|-----------|-----------|-----------|-----------|
| 12.5-14.9    | 1607 (59.9) | 524 (39.1) | 249 (18.6) | 178 (6.6) | 434 (16.2) |
| 15.0-17.4    | 1316 (59.0) | 373 (33.4) | 238 (21.3) | 144 (6.5) | 398 (17.8) |
| 17.5-19.9    | 1076 (62.5) | 323 (37.5) | 176 (20.4) | 116 (6.7) | 311 (18.1) |
| 20.0-22.4    | 794 (63.1)  | 247 (39.3) | 140 (22.3) | 82 (6.5)  | 267 (21.2) |
| 22.5-24.9    | 668 (66.8)  | 187 (37.4) | 141 (28.2) | 69 (6.9)  | 232 (23.2) |
| 25.0-27.4    | 477 (71.4)  | 162 (48.5) | 94 (28.1)  | 33 (4.9)  | 150 (22.5) |
| 27.5-29.9    | 296 (67.6)  | 94 (42.9)  | 58 (26.5)  | 22 (5.0)  | 102 (23.3) |
| 30.0-32.4    | 193 (67.0)  | 60 (41.7)  | 43 (29.9)  | 16 (5.6)  | 56 (19.4)  |
| ≥32.5        | 407 (72.4)  | 129 (45.9) | 105 (37.4) | 35 (6.2)  | 146 (26.0) |

*, calculated as per neonate.
Table 6. Association of GWG Category and the Composite Outcome by Maternal BMI Category (Used as Main Study Sample)

| GWG Category | Normal-weight (n=84,617) | Underweight (n=5,333) | Overweight (n=51,796) |
|--------------|--------------------------|-----------------------|-----------------------|
|              | Standardized GWG (kg)    | aOR (95% CI)          | P-value               | Standardized GWG (kg)    | aOR (95% CI)          | P-value               | Standardized GWG (kg)    | aOR (95% CI)          | P-value               |
| < 7.5        |                          | 2.04 (1.71-2.42)      | <0.001                | 1.71 (1.53-1.91)        | <0.001                |
| 7.5-9.9      |                          | 2.20 (1.90-2.55)      | <0.001                | 2.5-4.9                 | 1.47 (1.31-1.64)      | <0.001                |
| 10.0-12.4    |                          | 1.92 (1.75-2.12)      | <0.001                | 5.0-7.4                 | 1.23 (1.14-1.34)      | <0.001                |
| 12.5-14.9    |                          | 1.62 (1.52-1.72)      | <0.001                | 7.5-9.9                 | 1.04 (0.98-1.10)      | 0.251                 |
| 15.0-17.4    |                          | 0.81 (0.78-0.83)      | <0.001                | 15.0-17.4               | 0.81 (0.78-0.85)      | <0.001                |
| 17.5-19.9    |                          | 0.79 (0.77-0.82)      | <0.001                | 17.5-19.9               | 0.83 (0.79-0.87)      | <0.001                |
| 20.0-22.4    |                          | 0.85 (0.82-0.88)      | <0.001                | 20.0-22.4               | 0.92 (0.87-0.97)      | 0.001                 |
| 22.5-24.9    |                          | 0.82 (0.78-0.85)      | <0.001                | 22.5-24.9               | 0.94 (0.89-1.00)      | 0.043                 |
| 25.0-27.4    |                          | 1.04 (0.99-1.10)      | 0.151                 | 25.0-27.4               | 1.07 (0.99-1.14)      | 0.078                 |
| 27.5-29.9    |                          | 1.16 (1.08-1.24)      | <0.001                | 27.5-29.9               | 1.21 (1.11-1.32)      | <0.001                |
| ≥30.0        |                          | 1.21 (1.11-1.32)      | <0.001                | 30.0-32.4               | 1.28 (1.15-1.43)      | <0.001                |
|              |                          | 1.02 (0.99-1.05)      | <0.001                | 32.5-34.9               | 1.31 (1.14-1.51)      | <0.001                |
|              |                          | 1.92 (1.63-2.26)      | <0.001                | 35.0-37.4               | 1.68 (1.40-2.01)      | <0.001                |
|              |                          | 1.57 (1.27-1.93)      | <0.001                | 37.5-39.9               | 1.61 (1.27-2.03)      | <0.001                |
|              |                          | 2.84 (2.17-3.71)      | <0.001                | ≥40.0                   | 2.98 (2.25-3.96)      | <0.001                |

Obese Class I (n=30,477) | Obese Class II (n=16,191) | Obese Class III (n=12,396)

| GWG Category | Normal-weight (n=84,617) | Underweight (n=5,333) | Overweight (n=51,796) |
|--------------|--------------------------|-----------------------|-----------------------|
|              | Standardized GWG (kg)    | aOR (95% CI)          | P-value               | Standardized GWG (kg)    | aOR (95% CI)          | P-value               | Standardized GWG (kg)    | aOR (95% CI)          | P-value               |
| < 7.5        |                          | 1.23 (1.12-1.35)      | <0.001                | 1.23 (1.12-1.35)        | <0.001                | 1.31 (1.14-1.51)      | <0.001                |
| 7.5-9.9      |                          | 1.04 (0.92-1.16)      | 0.548                 | 2.5-4.9                 | 0.95 (0.85-1.08)      | 0.440                 |
| 10.0-12.4    |                          | 0.93 (0.84-1.03)      | 0.175                 | 5.0-7.4                 | 0.89 (0.80-1.00)      | 0.044                 |
| 12.5-14.9    |                          | 0.90 (0.82-0.98)      | 0.015                 | 7.5-9.9                 | 0.86 (0.78-0.96)      | 0.005                 |
|              |                          | 0.94 (0.86-1.03)      | 0.168                 | 10.0-12.4               | 0.92 (0.83-1.03)      | 0.137                 |
|              |                          | 1.05 (0.96-1.15)      | 0.295                 | 12.5-14.9               | 0.94 (0.85-1.05)      | 0.268                 |

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| Weight Range | aOR (95% CI) | P-value | Weight Range | aOR (95% CI) | P-value | Weight Range | aOR (95% CI) | P-value |
|--------------|--------------|---------|--------------|--------------|---------|--------------|--------------|---------|
| 15.0-17.4    | 0.85 (0.80-0.91) | <0.001  | 15.0-17.4    | 0.83 (0.76-0.91) | <0.001  | 15.0-17.4    | 0.90 (0.80-1.01) | 0.065   |
| 17.5-19.9    | 0.91 (0.85-0.98) | 0.009   | 17.5-19.9    | 0.94 (0.85-1.04) | 0.246   | 17.5-19.9    | 1.05 (0.92-1.20) | 0.471   |
| 20.0-22.4    | 0.99 (0.92-1.07) | 0.878   | 20.0-22.4    | 1.02 (0.90-1.15) | 0.781   | 20.0-22.4    | 1.08 (0.93-1.26) | 0.303   |
| 22.5-24.9    | 1.01 (0.93-1.11) | 0.793   | 22.5-24.9    | 1.11 (0.97-1.28) | 0.140   | 22.5-24.9    | 1.28 (1.07-1.52) | 0.006   |
| 25.0-27.4    | 1.11 (0.99-1.23) | 0.063   | 25.0-27.4    | 1.21 (1.02-1.43) | 0.030   | 25.0-27.4    | 1.61 (1.29-2.01) | <0.001  |
| 27.5-29.9    | 1.43 (1.25-1.64) | <0.001  | 27.5-29.9    | 1.27 (1.03-1.56) | 0.025   | 27.5-29.9    | 1.32 (1.01-1.72) | 0.038   |
| 30.0-32.4    | 1.25 (1.07-1.48) | 0.007   | 30.0-32.4    | 1.35 (1.06-1.73) | 0.017   | 30.0-32.4    | 1.27 (0.92-1.75) | 0.152   |
| 32.5-34.9    | 1.48 (1.21-1.82) | <0.001  | 32.5-34.9    | 1.36 (0.99-1.88) | 0.060   | 32.5-34.9    | 1.67 (1.31-2.13) | <0.001  |
| 35.0-37.4    | 1.79 (1.36-2.36) | <0.001  | ≥35.0        | 1.43 (1.11-1.85) | 0.006   | ≥35.0        | 1.67 (1.31-2.13) | <0.001  |
| 37.5-39.9    | 1.28 (0.93-1.75) | 0.133   | ≥40.0        | 2.87 (1.97-4.20) | <0.001  | ≥40.0        | 2.87 (1.97-4.20) | <0.001  |

aORs were obtained from multivariable models adjusted for maternal age, race, nulliparity, mode of conception, smoking status, and neonatal sex combination.
### Table 7. Comparison Between IOM 2009 and Current Optimal GWG Ranges and GWG Corresponding to Maternal Fetal Corpulence Symbiosis (MFCS)

| Maternal prepregnancy BMI | IOM 2009 for singletons | PROPOSED LINEAR MODEL GWG to have AGA newborns Robillard et al. 2018 (OptGWG=-1.2ppBMI+42) | IOM 2009 for twin pregnancies (Standardized for 36 weeks) | Optimal GWG ranges for twin pregnancies based on statistical-based approach | Optimal GWG ranges for twin pregnancies based on outcome-based approach | PROPOSED LINEAR MODEL Standardized GWG to have AGA newborns (GWG (kg)=-0.932ppBMI (kg/m²)+41.5) |
|--------------------------|-------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Underweight women < 18.5 kg/m² | 12.5-18 kg | 22.8 kg (16 kg/m²) 21.6 kg (17 kg/m²) 20.4 kg (18 kg/m²) | 20 to 23 kg | - | 15.9 to 22.7 kg | 17.5 to 24.9 kg | 26.6 kg (16 kg/m²) 25.7 kg (17 kg/m²) 24.7 kg (18 kg/m²) | 24 to 27 kg |
| Normal weight women 18.5-24.9 kg/m² | 11.5-16 kg | 19.2 kg (19 kg/m²) 18 kg (20 kg/m²) 16.8 kg (21 kg/m²) 15.6 kg (22 kg/m²) 14.4 kg (23 kg/m²) 13.2 kg (24 kg/m²) | 13 to 19 kg | 16.3 to 23.8 kg | 15.4 to 22.7 kg | 15.0 to 24.9 kg | 23.8 kg (19 kg/m²) 22.9 kg (20 kg/m²) 21.9 kg (21 kg/m²) 21 kg (22 kg/m²) 20.1 kg (23 kg/m²) 19.1 kg (24 kg/m²) | 19 to 24 kg |
| Overweight women 25-29.9 kg/m² | 7-11.5 kg | 12 kg (25 kg/m²) 10.8 kg (26 kg/m²) 9.6 kg (27 kg/m²) 8.4 kg (28 kg/m²) 7.2 kg (29 kg/m²) | 7 to 12 kg | 13.7 to 22.1 kg | 12.7 to 22.2 kg | 15.0 to 24.9 kg | 18.2 kg (25 kg/m²) 17.3 kg (26 kg/m²) 16.3 kg (27 kg/m²) 15.4 kg (28 kg/m²) 14.5 kg (29 kg/m²) | 14 to 18 kg |
| Obesity class I 30-34.9 kg/m² | 5-9 kg | 6 kg (30 kg/m²) 4.8 kg (31 kg/m²) 3.6 kg (32 kg/m²) 2.4 kg (33 kg/m²) 1.2 kg (34 kg/m²) | 1 to 6 kg | 11 to 18.6 kg | 10.0 to 20.0 kg | 10.0 to 19.9 kg | 13.5 kg (30 kg/m²) 12.6 kg (31 kg/m²) 11.7 kg (32 kg/m²) 10.7 kg (33 kg/m²) 9.8 kg (34 kg/m²) | 10 to 14 kg |
| Obesity class II 35-39.9 kg/m² | 5-9 kg | 0 kg (35 kg/m²) -1.2 kg (36 kg/m²) -2.4 kg (37 kg/m²) -3.6 kg (38 kg/m²) -4.8 kg (39 kg/m²) | 0 to -5kg | 11 to 18.6 kg | 7.7 to 18.1 kg | 7.5 to 17.4 kg | 8.9 kg (35 kg/m²) 7.9 kg (36 kg/m²) 7 kg (37 kg/m²) 6.1 kg (38 kg/m²) 5.2 kg (39 kg/m²) | 5 to 9 kg |
| Obesity class III | Over 40 kg/m² | 5-9 kg | -6 kg (40 kg/m²) | -7.2 kg (41 kg/m²) | -8.4 kg (42 kg/m²) | -9.6 kg (43 kg/m²) | -10.8 kg (44 kg/m²) | -12 kg (45 kg/m²) | -13.2 kg (46 kg/m²) | -6 kg | 11 to 18.6 kg | 5.9 to 16.3 kg | 5.0 to 9.9 kg | 4.2 kg (40 kg/m²) | 3.3 kg (41 kg/m²) | 2.4 kg (42 kg/m²) | 1.4 kg (43 kg/m²) | 0.5 kg (44 kg/m²) | -0.4 kg (45 kg/m²) | -1.4 kg (46 kg/m²) | -1 to 4 kg |
eFigure 1. Sex-Specific Birthweight Percentile Curves in Twins (Used as Both Main Study Sample and Validation Sample)
**Figure 2.** The Median and Interquartile Range (IQR) of GWG Rate in Low-Risk and High-Risk Subgroups Stratified by BMI Category (Used as Main Study Sample). Red line, low-risk subgroup; blue line, high-risk subgroup.
eFigure 3. Proportions of Inadequate, Adequate and Excessive GWG Defined Based on the Optimal Ranges (Statistical-Based and Outcome-Based Approach) and the IOM Recommendations by Prepregnancy BMI Category (Used as Validation Sample). *, the IOM recommendations are not available for underweight women with twin pregnancies.
**eFigure 4.** Adjusted Odd Ratios (aORs) for Perinatal Outcomes of Inadequate GWG (Used as Validation Sample). Red line: based on the optimal ranges by statistical-based approach; Blue line: based on the optimal ranges by outcome-based approach; Purple line: based on the IOM recommendations.
**eFigure 5.** Adjusted Odd Ratios (aORs) for Perinatal Outcomes of Excessive GWG (Used as Validation Sample). Red line: based on the optimal ranges by statistical-based approach; Blue line: based on the optimal ranges by outcome-based approach; Purple line: based on the IOM recommendations.