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Maternal and Child Health Outcomes Associated with Gestational Weight Gain by Body Mass Index: A Scoping Review

Prepared for the Committee on Exploring New Evidence on Weight Gain During Pregnancy and Perinatal Outcomes

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INTRODUCTION

Updated guidelines on weight gain during pregnancy were last published in 2009 by the Institute of Medicine (IOM, 2009). At that time, there was insufficient evidence to assess the effect of pregnancy weight gain on health outcomes among women in higher classes of obesity or those who were underweight. Additionally, the stratification of obesity into three classes: 1 (BMI = 30–34.9 kg/m^2), 2 (BMI = 35–39.9 kg/m^2), and 3 (BMI ≥ 40 kg/m^2) in the World Health Organization BMI classification system[5] has become more widely adopted, warranting an

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[5] Previously, obesity was primarily classified as BMI ≥ 30 kg/m^2.

updated review. To address this, the National Academies of Sciences, Engineering, and Medicine (the National Academies) was asked by the U.S. Department of Agriculture (USDA) and the Endocrine Society to conduct a scoping review[6] to examine the state of the evidence on health outcomes for both mother and child associated with gestational weight gain and stratified across prepregnancy body mass index (BMI) categories.

Thus, this scoping review was undertaken to provide an updated review of the amount of available evidence on health outcomes related to weight gain during pregnancy among those in higher BMI categories as well as underweight, since the release of the 2009 guidelines. The goal of this review was to focus on the following research question: What is the current amount of available evidence on maternal and child health outcomes associated with gestational weight gain stratified by prepregnancy or early pregnancy BMI?

APPROACH AND METHODS

Eligibility Criteria

The inclusion criteria for eligible studies were determined through discussions between the National Academies staff, the planning committee consultant (Lisa Bodnar), and the planning committee chair (Kathleen Rasmussen). These criteria are presented using the Population, Intervention/Exposure, Comparator, Outcome, and Study design (PICOS) framework. The search protocol was limited to primary articles published in English, in peer-reviewed journals between January 2008 and March 2025. The cutoff year of 2008 was used to limit the abundance of articles in the search, while ensuring that articles that were published in the year prior to the 2009 IOM guidelines were captured.

Table A-1 shows the eligibility criteria. The scoping review was limited to studies of gestational weight gain in adult women with a self-reported, measured, or electronic health record for pre-pregnancy or early pregnancy (first trimester) BMI outside of the normal BMI range (18.5–24.9 kg/m^2). Some studies were not clear on how weight was reported at the early pregnancy/pre-pregnancy timepoint or did not specify the mode of collection. Similarly, there was high variability in how weight (used to derive BMI values) was collected. Studies were required to have stratified the association between gestational weight gain and adverse outcomes by BMI classification. Articles that combined women with overweight or obesity in one group were excluded because obesity compared to overweight has different associations between pregnancy weight gain and adverse outcomes. However, studies that did not stratify by obesity class or studies that did stratify by classes 1, 2, and 3 were included. No restrictions were made on the health status of the study participants. All major maternal and child outcomes were included and later stratified by life course category. Only studies that categorized BMI using WHO cut points were included. For population sample size, cutoffs highlight the need for precise estimates of association, underscoring that future guidelines should be based on robust sample sizes. Studies of individuals who conceived via in vitro fertilization or other artificial fertilization

[6] This scoping review was conducted in conjunction with the planning of the National Academies workshop "Prepregnancy BMI and Gestational Weight Gain: New Evidence, Emerging Innovations, and Policy Implications." The scoping review will be presented at this workshop by Lisa Bodnar, who serves as consultant to the workshop planning committee.

methods were excluded because weight gain patterns in these populations differ from the general pregnant population.

TABLE A-1 Eligibility Criteria for Scoping Review on Maternal and Child Health Outcomes Associated with Gestational Weight Gain by Body Mass Index

Category	Inclusion Criteria	Exclusion Criteria
Study participants	Women (age >18 years) with a preconception/prepregnancy (including early pregnancy) BMI classified as underweight (< 18.5 kg/m²), overweight (25.0–29.9 kg/m²), Class 1 obesity (30.00–34.99 kg/m²), Class 2 obesity (35.00–39.99 kg/m²), or Class 3 obesity (≥ 40.00 kg/m²); neonates (0–28 days), infants (0–12 months), children (1–18 years)	Studies that only look at women with preconception/prepregnancy (including early pregnancy) BMI classified as normal (18.5–24.9 kg/m²)
		Studies that did not collect or use gestational age for analyses for preeclampsia and GDM (among other outcomes)
	Singleton pregnancies	Studies with in vitro or artificial fertilization
		Children who have reached adulthood
		Teen pregnancies
		Multiple pregnancies
Health status of study participants	Any health status	N/A
Sample Size	Cohort studies:	Cohort studies:
	Individual BMI classes (i.e., underweight, Class 1, 2, 3): $n \geq 300$	Individual BMI classes (i.e., underweight, Class 1, 2, 3): $n < 300$
	Obese (not stratified by class): $n \geq 500$	Obese (not stratified by class): $n < 500$
	Obese combined with overweight: $n \geq 500$	Obese combined with overweight: $n < 500$
	Overweight: $n \geq 500$	Overweight: $n < 500$
	Normal: $n \geq 500$	Normal: $n < 500$
	Case–control studies: cases: $n \geq 50$; controls can be any size	Case–control studies: cases: $n < 50$; controls can be any size
Confounders	Study adjusted for at least one confounder	Study did not adjust for at least one confounder
Interventions/ exposures	Gestational weight gain with associations stratified by prepregnancy/early pregnancy BMI	Gestational weight gain with associations, not stratified by BMI
		BMI treated only as a confounder

Comparators	N/A	N/A
Outcomes	Maternal and child health outcomes, including neonatal outcomes, birth, maternal postpartum outcomes, maternal intrapartum outcomes, pregnancy or antepartum complications, maternal health, pregnancy health, fetal outcomes, infant outcomes, neonatal health, childhood outcomes	N/A
Study design	Randomized controlled trials Nonrandomized controlled trials, including quasi-experimental and controlled observation before-and-after studies Prospective cohort studies Retrospective cohort studies Case–control studies Cross-sectional studies	Editorials Narrative reviews Abstracts/conference abstracts Study protocols Grey literature Case reports, studies, series Letters Meta-analyses, systematic reviews
Publication status	Articles published in peer-reviewed journals	Articles that have not been peer reviewed and are not published in peer-reviewed journals, including unpublished data, manuscripts, preprints, reports, abstracts, and conference proceedings
Date of publication	January 2008 until the search date of March 25, 2025	Articles published prior to January 2008 or after search date of March 25, 2025
Language of publication	Articles published in English	Articles published in languages other than English
Country	Countries that rank very high or high on the UN Human Development Index[7] (0.7 or higher) at the time of publication	Countries that rank medium or low on the UN Human Development Index (< 0.7) at the time of publication Countries in South Asia owing to difference in BMI categories compared to World Health Organization (WHO) BMI categories)

NOTE: BMI = body mass index; GDM = gestational diabetes mellitus.

Literature Search

A National Academies research librarian, in consultation with National Academies staff, the planning committee consultant, and the planning committee chair, designed the literature search strategy and searched MEDLINE, PubMed, Embase, and Scopus on March 25, 2025. The

[7] UN Human Development Index: https://hdr.undp.org/data-center/human-development-index#/indicies/HDI. (accessed August 6, 2025).

search results were managed and deduplicated using EndNote software (EndNote, 2013). A sample search strategy for MEDLINE is shown in Table A-2. The search results were uploaded into PICO Portal, a web-based, AI-powered systematic and scoping review management platform for evidence reviews.

Screening

Two phases of screening were conducted; in each phase, all articles were screened independently by two reviewers (trained staff from the National Academies). Screening was conducted using PICO Portal, and decisions were based on the inclusion and exclusion criteria determined a priori (PICO Portal, 2023). Each article was reviewed to determine if it met the inclusion criteria; if any of the exclusion criteria were met, the article was excluded. Any discrepancies in reviewer decisions were decided through discussion in reaching consensus or by additional trained staff who served as a third reviewer.

In the first phase of screening, 10,631 article titles and abstracts were screened by two independent reviewers using the prespecified criteria shown in Table A-1. In the second phase, the full text of 1,228 articles was screened by two independent reviewers. After full-text screening, 123 articles met full-inclusion criteria and are reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist for scoping reviews (Tricco et al., 2018; see Figure A-1).

TABLE A-2 Sample MEDLINE Search Strategy for Scoping Review on Maternal and Child Outcomes Associated with Gestational Weight Gain by Body Mass Index

#	Query
1	Body mass index/
2	Gestational weight gain/ or Pregnancy in obesity/ or Perinatal care/ or Postnatal care/ or Preconception care/ or Prenatal care/ or Maternal health/ or Postpartum period/ or Pregnancy/ or Pregnancy complications/ or Pregnant people/
3	(Randomized controlled trial or Controlled clinical trial or Controlled before-after or Observational study).pt.
4	Case-control studies/ or Prospective studies/ or Retrospective studies/ or Cross-sectional studies/ or "Non-randomized controlled trials as topic"/ or "follow-up studies"/ or "longitudinal studies"/
5	3 or 4
6	1 and 2 and 5
7	(Editorial or Abstracts or Case reports or Letter or Meta-analysis or Systematic review).pt.
8	Congresses as topic/ or Clinical trial protocols as topic/
9	7 or 8
10	6 not 9
11	10 not (exp animals/ not humans/)
12	("Hong Kong" or "United Kingdom" or england or scotland or "Great Britain" or "Northern Ireland" or wales or albania or algeria or andorra or "Antigua and Barbuda" or argentina or armenia or australia or austria or azerbaijan or bahamas or bahrain or barbados or belarus or belgium or belize or "Bosnia and Herzegovina" or botswana or brazil or brunei or bulgaria or canada or chile or china or colombia or "Costa Rica" or croatia or cuba or cyprus or czechia or denmark or dominica or "Dominican Republic" or ecuador or egypt or estonia or fiji or finland or

	france or georgia or germany or greece or grenada or guyana or hungary or iceland or indonesia or iran or ireland or israel or italy or jamaica or japan or jordan or kazakhstan or korea or kuwait or kyrgyzstan or latvia or lebanon or libya or liechtenstein or lithuania or luxembourg or malaysia or maldives or malta or "Marshall Islands" or mauritius or mexico or moldova or mongolia or montenegro or netherlands or "New Zealand" or macedonia or norway or oman or palau or palestine or panama or paraguay or peru or philippines or poland or portugal or qatar or romania or russia or "Russian Federation" or "Saint Kitts and Nevis" or "Saint Lucia" or "Saint Vincent and the Grenadines" or samoa or "San Marino" or "Saudi Arabia" or serbia or seychelles or singapore or slovakia or slovenia or "South Africa" or spain or "Sri Lanka" or sweden or switzerland or thailand or tonga or "Trinidad and Tobago" or tunisia or turkey or turkmenistan or ukraine or "United Arab Emirates" or uruguay or uzbekistan or "Viet Nam" or "USA" or "united states" or "alabama" or "alaska" or "arizona" or "arkansas" or "california" or "colorado" or "connecticut" or "delaware" or "florida" or "georgia" or "hawaii" or "idaho" or "illinois" or "indiana" or "iowa" or "kansas" or "kentucky" or "louisiana" or "maine" or "maryland" or "massachusetts" or "michigan" or "minnesota" or "mississippi" or "missouri" or "montana" or "nebraska" or "nevada" or "new hampshire" or "new jersey" or "new mexico" or "new york" or "north carolina" or "north dakota" or "ohio" or "oklahoma" or "oregon" or "pennsylvania" or "rhode island" or "south carolina" or "south dakota" or "tennessee" or "texas" or "utah" or "vermont" or "virginia" or "washington" or "west virginia" or "wisconsin" or "wyoming" or "district of columbia").mp.
13	11 and 12
14	limit 13 to (english language and yr="2005 -Current")

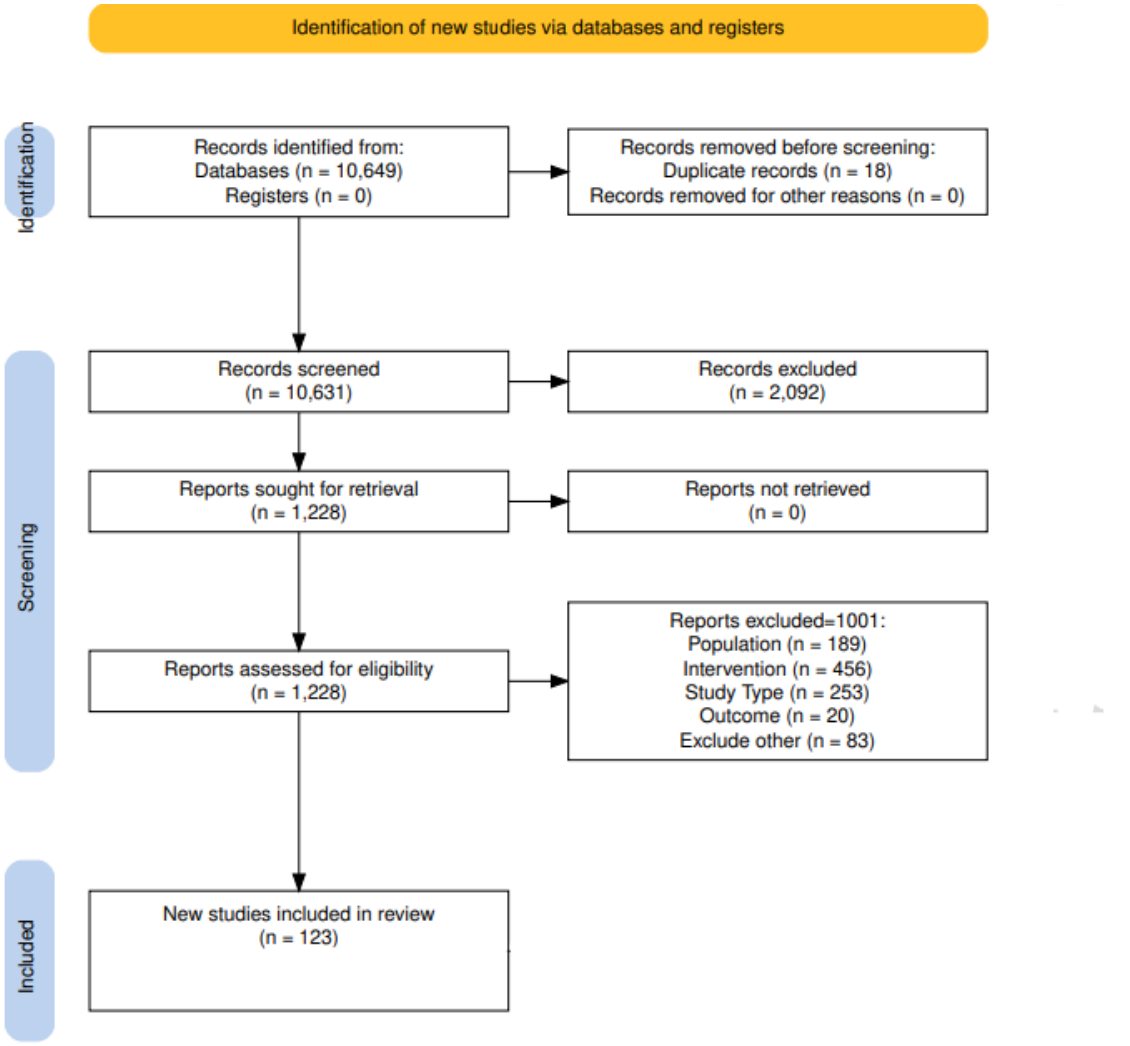

FIGURE A-1 PRISMA flow diagram of selection process for scoping review on maternal and child health outcomes associated with gestational weight gain by body mass index.
NOTE: n = number. During the initial abstract screening phase, a 95 percent threshold was set for inclusion based on PICO Portal's AI-integrated algorithm.[8]

Data Extraction

The National Academies staff generated data extraction templates designed to extract variables identified and approved by the planning committee consultant and planning committee chair. Trained National Academies staff members extracted data using an Excel spreadsheet and predetermined criteria.

[8] PICO Portal. 2023. Machine learning-assisted screening increases efficiency of systematic review. https://picoportal.org/2023/05/08/mla/ (accessed August 8, 2025).

DESCRIPTIVE RESULTS

Overall, 123 articles met the inclusion criteria, with 62 articles reporting maternal outcomes and 97 articles reporting infant and child outcomes (see Annex Table A-1). Twenty-one percent of articles reported only maternal outcomes, 49 percent reported only infant and child outcomes, and 29 percent reported both maternal and infant and child outcomes (see Figure A-2).

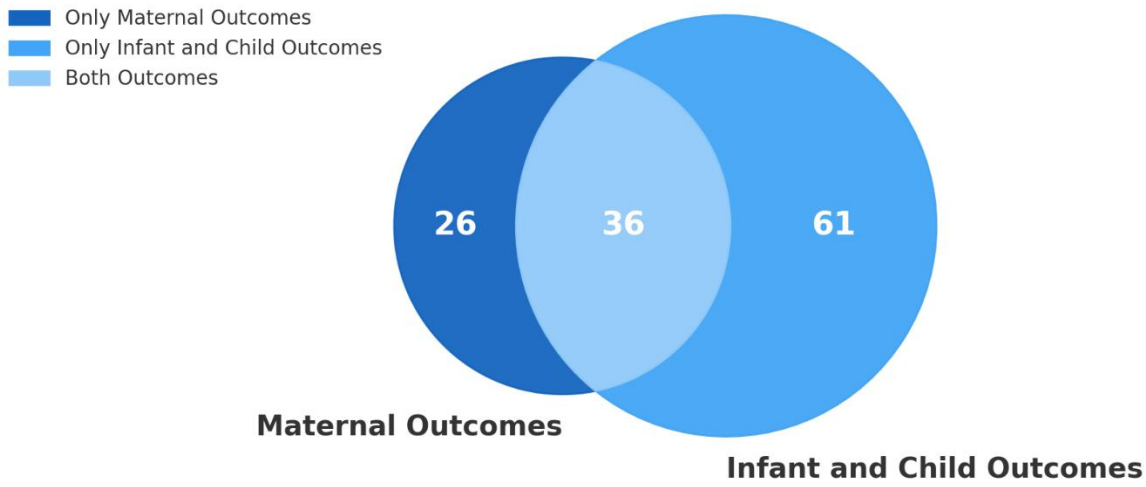

FIGURE A-2 Proportion of articles for maternal and infant/child outcomes, 2008–2025.

Maternal outcomes were categorized by life course stage: (1) antepartum, (2) intrapartum, (3) short-term postpartum (delivery to 11.9 months), and 4) long-term postpartum (>11.9 months). Intrapartum outcomes accounted for the largest share (61 percent), followed by antepartum (56 percent), short-term postpartum (32 percent), and long-term postpartum (18 percent), primarily driven by the high prevalence (89 percent) of studies reporting any type of cesarean delivery, which was the most common maternal outcome reported across all categories (see Table A-3).

TABLE A-3 Frequency of Reported Maternal Outcomes, 2008–2025

Category	N	Subtype	N (%)
Antepartum	35	GDM	21 (60)
		Preeclampsia	21 (60)
		Pregnancy-induced hypertension	14 (40)
		Other[a]	4 (11)
		Eclampsia	3 (8.6)
		Miscarriage	2 (5.7)
Intrapartum	38	Cesarean delivery	34 (89)
		Induction of labor	7 (18)
		Operative vaginal delivery	5 (13)
		Other[b]	4 (11)
		Normal vaginal delivery	3 (7.9)
		Chorioamnionitis	3 (7.9)

		Medications administered	3 (7.9)
		Hydramnios	2 (5.3)
Short-term postpartum (0-11.9 months)	20	PPWR	9 (45)
		Other[c]	5 (25)
		Maternal morbidity	3 (15)
		Depression	3 (15)
		Cardiometabolic disease[d]	3 (15)
		Hospital stay duration	2 (10)
		Postpartum hemorrhage	2 (10)
Long-term postpartum (11.9+ months)	11	PPWR	8 (73)
		Cardiometabolic disease	3 (27)
		Other[e]	3 (27)

NOTE: Articles may report more than one maternal outcome. Other outcomes are defined as an outcome that was only reported once out of 62 articles. GDM = gestational diabetes mellitus; PPWR = postpartum weight retention.

[a] Other Antepartum outcomes include gestational hepatography, preterm labor, polyhydramnios, need for pharmacological treatment, and abortion.

[b] Other intrapartum outcomes include blood transfusion, unplanned hysterectomy, maternal ICU admission, intrapartum bleeding, anemia, augmentation of labor, and delivery duration.

[c] Other short-term postpartum outcomes include maternal mortality, return to prepregnancy BMI, breastfeeding initiation/duration, degenerative musculoskeletal conditions, and anxiety.

[d] For short-and long-term postpartum outcomes, cardiometabolic disease includes metabolic syndrome, hypertension, Type II diabetes mellitus, and cardiovascular disease.

[e] Other long-term postpartum outcomes include maternal obesity, return to prepregnancy BMI, and degenerative musculoskeletal conditions.

Cesarean delivery, gestational diabetes mellitus (GDM), preeclampsia, pregnancy-induced hypertension, postpartum weight retention (PPWR), and induction of labor were the most reported outcomes regardless of stratified life course category. There was less variability in reported long-term postpartum outcomes (5 subtypes) compared to short-term postpartum outcomes (11 subtypes).[9]

Infant and child outcomes were categorized by life course stage: (1) delivery, (2) infant (0–11.9 months), (3) childhood (1–3 years), (4) childhood (4–8 years), and (5) childhood (9–18 years). Delivery outcomes accounted for the largest share (76 percent), followed by infant (26 percent), children 4–8 years (20 percent), children 1–3 years (16 percent), and children 9–18 years (9.4 percent) (see Table A-4).

TABLE A-4 Frequency of Reported Infant and Child Outcomes, 2008–2025

Category	N	Subtype	N (%)
Delivery	73	LGA	39 (53)
		SGA	35 (48)
		Preterm birth	26 (36)
		Birth weight	20 (27)
		NICU admission	14 (19)
		Macrosomia	13 (18)
		Other[a]	12 (16)

[9] Subtypes refer to the unique count of outcomes. For example, long-term postpartum outcomes included PPWR, cardiometabolic disease, maternal obesity, return to prepregnancy BMI, and degenerative musculoskeletal conditions.

		Stillbirth	7 (9.6)
		Apgar score	7 (9.6)
		Shoulder dystocia	5 (6.8)
		Trauma	4 (5.5)
		Ventilation	4 (5.5)
		Seizures	4 (5.5)
		Adequate for gestational age	2 (2.7)
		Neonatal morbidity	2 (2.7)
		Neonatal mortality	2 (2.7)
		NEC	2 (2.7)
		Hemorrhage	2 (2.7)
		Sepsis	2 (2.7)
Infant (0–11.9 months)	25	Infant mortality	11 (44)
		Respiratory distress syndrome	5 (20)
		Neonatal hypoglycemia	4 (16)
		Congenital abnormalities	4 (16)
		Hyperbilirubinemia	3 (12)
		Neonatal hospitalization	3 (12)
		Infant weight	3 (12)
		BMI	3 (12)
		Other[b]	3 (12)
		Infant morbidity	2 (8.0)
		Allergies/Atopy	2 (8.0)
		Transfer to higher level care	2 (8.0)
Child (1–3 years)	15	Obesity	10 (64)
		Allergies/Atopy	4 (29)
		Intellectual development disorders	1 (7.1)
Child (4–8 years)	19	Obesity	11 (58)
		Allergies/Atopy	4 (21)
		Intellectual development disorders	2 (11)
		Other[c]	2 (11)
Child (9–18 years)	9	Obesity	5 (56)
		Allergies/Atopy	2 (22)
		Other[d]	2 (22)

NOTE: Other outcomes are defined as an outcome that was only reported once out of 97 articles. Articles may report more than one outcome. Percentages represent the proportion of outcomes in relation to the life course category. For example, LGA comprised 53 percent of all delivery outcomes. N = number; BMI = body mass index; LGA = large-for-gestational age; SGA = small-for-gestational age; NICU = neonatal intensive care unit; NEC = necrotizing enterocolitis.

[a] Other delivery outcomes include term and postterm birth, antibiotics use, intrauterine growth restriction, breech presentation, placental weight, intellectual development disorders, neonatal metabolic abnormality, noncephalic presentation, umbilical cord pH, estimated blood loss, meconium aspiration, preterm premature rupture of membranes.

[b] Other infant (0–11.9 months) outcomes include infant length, intellectual development disorders, and breastfeeding (including exclusive).

[c] Other child (4–8 years) outcomes include hyperactivity-inattention symptoms and early onset of thelarche and pubarche.

[d] Other child (9–18 years) outcomes include intellectual development disorders and early onset of thelarche and pubarche.

Articles that reported on women with pre-pregnancy conditions were not quantified in analyses. Articles were included even if they did not account for gestational age in their analyses or methodology (See Box A-1). Large-for-gestational age (LGA), small-for-gestational age (SGA), preterm birth, birth weight, and neonatal intensive care unit (NICU) admission were the most reported outcomes regardless of stratified life course category. For SGA and LGA, 76 percent of unique articles reported both outcomes. These outcomes were often reported together when examining gestational weight gain to comprehensively measure both growth restriction (SGA < 10th percentile of birth weight) and excessive growth (LGA > 90th percentile of birth weight). However, accounting for gestational age when measuring the associations between GWG and infant mortality, stillbirth, birth weight, and preterm birth are important for timing of outcomes relative to duration of pregnancy. Most articles did account for gestational age (range of 75 percent to 100 percent), with the most variation in articles measuring birth weight (see Figure A-3).

BOX A-1

Methods Used in Studies to Account for Gestational Age in Measurements of Gestational Weight Gain

1. Limit the sample to term births (e.g., gestational age 37 weeks or more).
2. Calculate a rate of weight gain as the total weight gain divided by the weeks of gestation (e.g., 10 kg/30 weeks = 0.33 kg/week).
3. Calculate weight gain adequacy as a measure of how the participant's weight gain compares with the 2009 IOM guidelines based on gestational age.
4. Use pregnancy weight gain z-score charts to standardize weight gain according to gestational age.
5. Adjust for gestational age in the regression model.

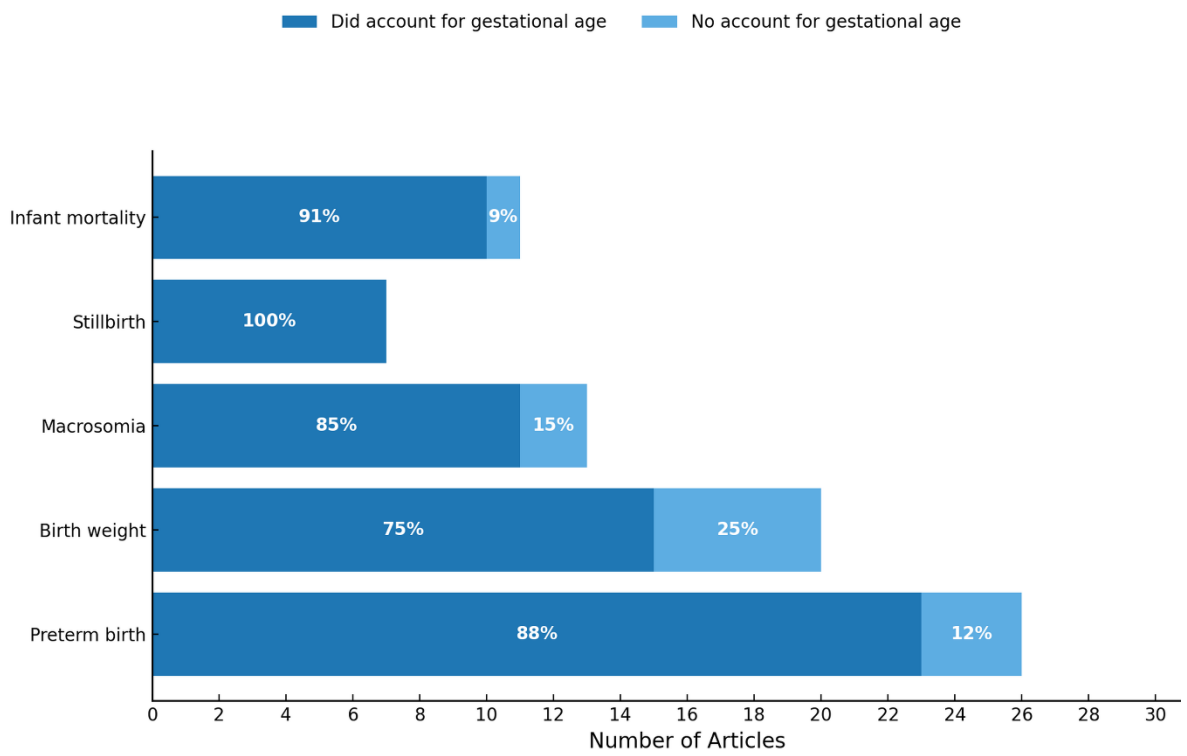

FIGURE A-3 Percentage of articles accounting for gestational age: stratified by outcome, 2008–2025.

Grouping delivery outcomes by morbidity and mortality allows for higher accuracy for assessing higher-risk outcomes. Therefore, fetal and infant mortality (including both infant and neonatal mortality and stillbirth), infant morbidity (preterm birth, NICU admission, shoulder dystocia, trauma at delivery, ventilation, seizures, neonatal morbidity, NEC, hemorrhage, and sepsis), and other delivery outcomes (SGA, LGA, macrosomia, birth weight, Apgar score, adequate-for-gestational age, and other outcomes)[10] were categorized together (see Figure A-4). The highest count (n = 128) occurred for other delivery outcomes, followed by infant morbidity (n = 65), and infant mortality (n = 20). Preterm birth (n = 26) and NICU admission (n = 14) contributed the highest proportion of reported morbidity outcomes, while neonatal morbidity, NEC, hemorrhage, and sepsis had the lowest count.

[10] Other outcomes were categorized together since they were only reported in one article yet demonstrate the variability of outcomes reported in the scoping review (see note in Table A-4).

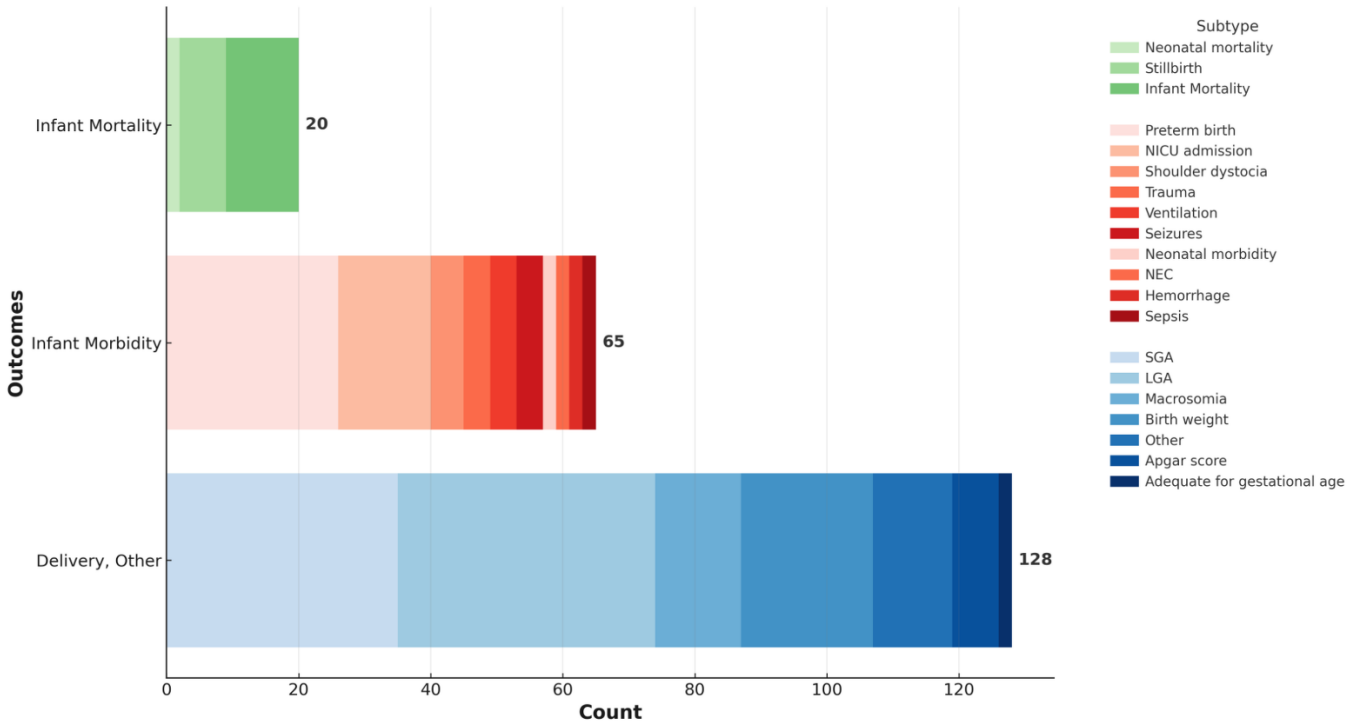

FIGURE A-4 Infant morbidity and mortality outcomes by subtype, 2008–2025.
NOTE: Articles may report more than one outcome. Other delivery outcomes that were only reported by one article include: term and postterm birth, antibiotics use, intrauterine growth restriction, breech presentation, placental weight, intellectual development disorders, neonatal metabolic abnormality, noncephalic presentation, umbilical cord pH, estimated blood loss, meconium aspiration, preterm premature rupture of membranes. LGA = large-for-gestational age; SGA = small-for-gestational age; NICU = neonatal intensive care unit; NEC = necrotizing enterocolitis.

An evidence map was created for the top 20 most frequently reported maternal, infant, and child outcomes, stratified by prepregnancy or early pregnancy BMI (see Figure A-5). These outcomes were mapped across six BMI exposure categories: underweight, overweight, obesity (unstratified), and Classes 1, 2, and 3 obesity. LGA and SGA were consistently reported across all BMI groups. Cesarean delivery and preterm birth were also widely reported across BMI categories and, together with LGA and SGA, reflect standardized clinical outcomes that are more routinely collected in perinatal research.

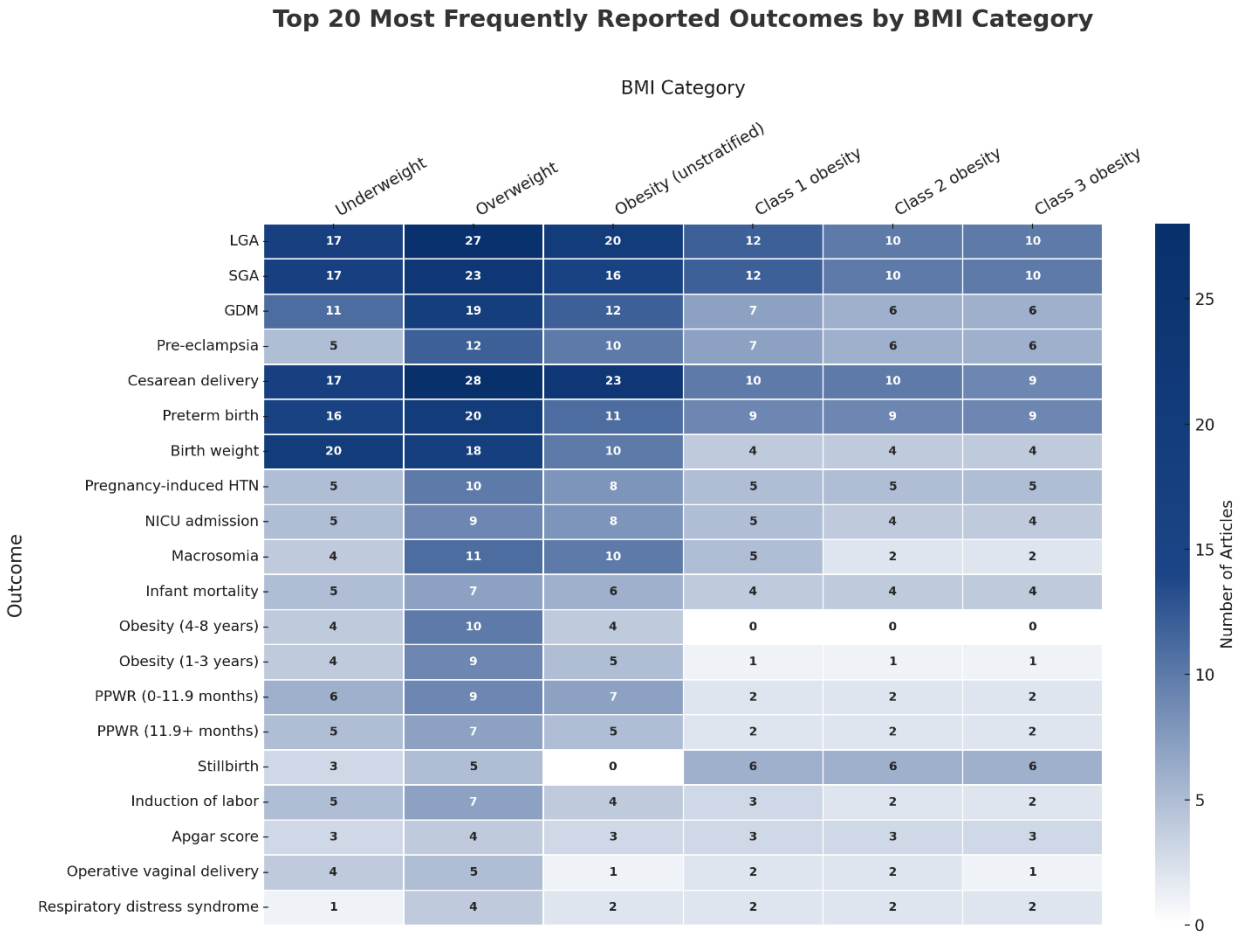

FIGURE A-5 Evidence map, top 20 most frequently reported outcomes stratified by BMI prepregnancy or early pregnancy BMI.
NOTE: LGA = large-for-gestational age; SGA = small-for-gestational age; GDM = gestational diabetes mellitus; HTN = hypertension; NICU = neonatal intensive care unit; PPWR = postpartum weight retention.

Overweight comprised the highest reported BMI category (106 articles; 86 percent), followed by underweight (69 articles; 56 percent); obesity, not stratified (62 articles; 50 percent); Class 1 obesity (42 articles; 34 percent); Class 2 obesity (34 articles; 28 percent); and Class 3 obesity (31 articles; 25 percent). Three articles combined Classes 2 and 3 obesity and one article combined Classes 1 and 2 obesity; those values are accounted for in both BMI categories that were combined (See Figure A-5). Fewer articles reported outcomes stratified by Classes 1, 2, and 3 obesity, with overall counts decreasing as BMI was stratified by class. While overweight and obesity (unstratified) categories had broader outcome coverage, there was an evidence gap for reported outcomes within Classes 2 and 3 obesity. Given the inclusion sample size for obesity classes ($n \geq 300$), fewer studies met the inclusion criteria compared to the unstratified obesity sample sizes ($n \geq 500$). Additionally, outcomes such as postpartum weight retention, child obesity, and respiratory distress syndrome were underrepresented in studies reporting by stratified BMI.

This scoping review captures the most recent peer-reviewed evidence published since the 2009 IOM gestational weight gain guidelines. Out of 123 articles published between January

2008 and March 25, 2025, cesarean delivery, LGA, SGA, and preterm birth were the most frequently reported adverse outcomes, often measured within the same studies as they are common outcomes reported for clinical surveillance and research. While more evidence exists on outcomes associated with higher class BMI categories than were available before 2008, evidence gaps remain, particularly for multiple outcomes, including short-term and long-term postpartum weight retention, child obesity at all life stages, and other adverse delivery and infant outcomes.

ACKNOWLEDGEMENTS

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EDITOR CONTRIBUTIONS

The editor's responsibilities were as follows—Jennifer Stephenson, Alice Vorosmarti, Lisa Bodnar, and Ann Yaktine: designed the research study; Jennifer Stephenson, Alice Vorosmarti: conducted the research; Jennifer Stephenson: assessed the data and developed the manuscript; Jennifer Stephenson, Alice Vorosmarti, Lisa Bodnar, Ann Yaktine: edited the manuscript; and all editors have read and approved the final manuscript.

CONFLICT OF INTEREST AND FUNDING

USDA and the Endocrine Society provided financial support to the National Academies of Sciences, Engineering, and Medicine. Internal funding was also provided. All editors declare that they have no known competing financial interests or personal relationships that could appear to influence the work reported in this paper.

REVIEWERS

To ensure that it meets institutional standards for quality and objectivity, this appendix was reviewed by Nicole Marshall, Oregon Health & Science University, and Andrea Deierlein, New York University. Leslie Sim, National Academies of Sciences, Engineering and Medicine served as the review coordinator.

For additional information regarding the workshop, visit https://www.nationalacademies.org/our-work/exploring-new-evidence-on-weight-gain-during-pregnancy-and-perinatal-outcomes-a-workshop.

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A-1

Annex: Included Articles

ANNEX TABLE A-1 Included Articles by Maternal and Infant and Child Outcomes

Author	Year	Maternal Outcome	Infant, Child Outcome
Abebe, D. S.	2015	✔	
Aghaee, S.	2019		✔
Alberico, S.	2014	✔	✔
Amyx, M.	2023	✔	
Ashley-Martin, J.	2014	✔	
Badon, S. E.	2021	✔	✔
Badon, S. E.	2020		✔
Beyerlein, A.	2012		✔
Beyerlein, A.	2010	✔	✔
Bider-Canfield, Z.	2017		✔
Black, M. H.	2013	✔	✔
Bliddal, M.	2015	✔	
Bliddal, M.	2016	✔	
Bodnar, L. M.	2016	✔	✔
Bodnar, L. M.	2018	✔	
Boone-Heinonen, J.	2024		✔
Bouvier, D.	2019	✔	✔
Carlhäll, S.	2020	✔	✔
Carnero, A. M.	2012		✔
Carreno, C. A.	2012	✔	✔
Castillo, H.	2015		✔
Castillo, H.	2016	✔	✔
Chen, A.	2009		✔
Chen, H. Y.	2019		✔
Chen-Xu, J.	2022	✔	✔

Chiossi, G.	2024		✔
Class, Q. A.	2022	✔	✔
Cosson, E.	2016	✔	✔
Cox Bauer, C. M.	2016	✔	✔
Crane, J. M. G.	2009	✔	✔
Declercq, E.	2016		✔
Dimitris, M. C.	2023		✔
Dimitris, M. C.	2022	✔	
Dow, C.	2022		✔
Drucker, A. M.	2019		✔
Dumas, O.	2022		✔
Dumas, O.	2016		✔
Durie, D. E.	2011	✔	✔
Durmus, B.	2012	✔	✔
Durst, Jennifer K.	2016	✔	✔
Eick, S. M.	2020		✔
El Rafei, R.	2016		✔
El Rafei, R.	2018		✔
Ensenauer, R.	2013		✔
Gawade, P.	2011	✔	
Guo, Y.	2023		✔
Guo, Y.	2024		✔
Han, S. Y.	2016	✔	
Harpsøe, M. C.	2012		✔
Haugen, M.	2014	✔	✔
Hinkle, S. N.	2012		✔
Houde, M.	2015	✔	✔
Huang, L.	2014		✔
Hunt, K. J.	2013		✔
Hutcheon, J. A.	2018	✔	
Jain, A. P.	2016		✔
Jeric, M.	2013		✔
Joaquino, S. M.	2021		✔
Johansson, K.	2024	✔	✔

Johansson, K.	2018		✔
Johnson, D.	2023	✔	
Ketterl, T. G.	2018	✔	
Kirkegaard, H.	2021	✔	
Kirkegaard, H.	2014	✔	
Lee, P. M. Y.	2021		✔
Leermakers, E. T. M.	2013		✔
Lengyel, C. S.	2017		✔
Leonard, S. A.	2020	✔	
Leonard, S. A.	2017		✔
Leonard, S. A.	2017		✔
Li, S.	2013		✔
Liu, X.	2022		✔
MacDonald, S. C.	2017	✔	
Machado, C.	2020	✔	✔
Madzia, J.	2021		✔
Mamun, A. A.	2011	✔	✔
Margerison Zilko, C. E.	2010	✔	✔
Mbah, A. K.	2010	✔	
McCurdy, R. J.	2022	✔	
McDonald, S. D.	2018		✔
Meštrović, Z.	2019		✔
Moore Simas, T. A.	2012		✔
Morken, N. H.	2013	✔	
Mourtakos, S. P.	2017		✔
Mustaniemi, S.	2021		✔
Niknam, A.	2024		✔
Nilses, C.	2017	✔	
Nohr, E. A.	2009	✔	✔
Nohr, E. A.	2008	✔	✔
Oza-Frank, R.	2013	✔	✔
Palumbo, A. M.	2025		✔
Petersen, J. M.	2023		✔
Polinski, K. J.	2022		✔

Premru-Srsen, T.	2019	✔	
Robinson, C. J.	2010	✔	
Rockhill, K.	2015		✔
Salihu, H. M.	2009		✔
Santos Monteiro, S.	2023	✔	✔
Shin, D.	2014	✔	✔
Simko, M.	2019	✔	✔
Simonsen, S. E.	2013		✔
Sorbye, L. M.	2017	✔	
Stamnes Køpp, U. M.	2012		✔
Tabet, M.	2017		✔
Tranidou, A.	2023	✔	
Truong, Y. N.	2015	✔	✔
Tutlam, N. T.	2017		✔
Ukah, U. Vivian	2019	✔	✔
Vesco, K. K.	2011		✔
von Kries, R.	2010		✔
Wang, L.	2021		✔
Wang, X.	2020		✔
Weschenfelder, F.	2021	✔	✔
Weschenfelder, F.	2019	✔	✔
Widen, E. M.	2023	✔	✔
Wilkins, E. G.	2023	✔	✔
Wu, B.	2024		✔
Xu, H.	2020	✔	
Xu, H.	2022	✔	
Yao, R.	2017		✔
Yee, L. M.	2017	✔	✔
Ylöstalo, T.	2024		✔
Zhu, Y.	2023		✔