

Risk Factors for Childhood Obesity in the First 1,000 Days

A Systematic Review



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Context: Mounting evidence suggests that the origins of childhood obesity and related disparities can be found as early as the “first 1,000 days”—the period from conception to age 2 years. The main goal of this study is to systematically review existing evidence for modifiable childhood obesity risk factors present from conception to age 2 years.

Evidence acquisition: PubMed, Embase, and Web of Science were searched for studies published between January 1, 1980, and December 12, 2014, of childhood obesity risk factors present during the first 1,000 days. Prospective, original human subject, English-language research with exposure occurrence during the first 1,000 days and with the outcome of childhood overweight or obesity (BMI \geq 85th percentile for age and sex) collected between age 6 months and 18 years were analyzed between December 13, 2014, and March 15, 2015.

Evidence synthesis: Of 5,952 identified citations, 282 studies met inclusion criteria. Several risk factors during the first 1,000 days were consistently associated with later childhood obesity. These included higher maternal pre-pregnancy BMI, prenatal tobacco exposure, maternal excess gestational weight gain, high infant birth weight, and accelerated infant weight gain. Fewer studies also supported gestational diabetes, child care attendance, low strength of maternal–infant relationship, low SES, curtailed infant sleep, inappropriate bottle use, introduction of solid food intake before age 4 months, and infant antibiotic exposure as risk factors for childhood obesity.

Conclusions: Modifiable risk factors in the first 1,000 days can inform future research and policy priorities and intervention efforts to prevent childhood obesity.

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Context

High obesity prevalence persists in all age groups in the U.S., and one third of U.S. children aged 2–19 years are affected by overweight or obesity (sex-specific BMI \geq 85th percentile for age).¹

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Approximately 8.1% of U.S. children younger than age 2 years have weight-for-length \geq 95th percentile, predisposing them to obesity. The first 1,000 days describes the period from conception through age 2 years, which is increasingly recognized as a critical period for development of childhood obesity and its adverse consequences.²

Childhood obesity, and its disparate impact on underserved populations, originates in early life.^{3,4} Among children aged 2–5 years, Hispanic children have almost fivefold and non-Hispanic black children have threefold higher obesity prevalence compared with their non-Hispanic white counterparts.^{1,5–7} During the first years of life, racial/ethnic differences in modifiable risk factors for childhood obesity contribute substantially to racial/ethnic disparities in later childhood obesity.^{8–13}

Despite mounting evidence that the first 1,000 days are important in the prevention of childhood obesity and in the reduction in obesity disparities, no systematic review

has focused on risk factors from conception through age 2 years. Identifying current evidence for childhood obesity risk factors during the first 1,000 days will advance understanding of the origins of obesity and inform future research priorities and efforts to prevent childhood obesity.

The goal of this study is to systematically review existing evidence for modifiable childhood obesity risk factors that are present from conception to age 2 years. This review focuses on prospective studies and uses a conceptual framework that incorporates individual, family, community, and systems levels to highlight future research needs.

Evidence Acquisition

Conceptual Framework

The Glass and McAtee¹⁴ model of multi-level influences on behavior and health informed the overarching conceptual framework (Figure 1). The model outlines macro (environmental); mezzo (community); and micro (parent/family/caregiver) levels of “above water” influences, and individual-level health behaviors at the “waterline.” This study focuses on potentially modifiable risk factors for childhood obesity during two life-course stages:

1. from conception to delivery; and
2. from birth to age 2 years.

“Under water” metabolic and genetic risk factors are briefly summarized.

Search Strategy and Data Extraction

Methods followed the IOM and Patient-Centered Outcomes Research Institute standards.^{15,16} Studies published between January 1, 1980, and December 12, 2014, were included. PubMed, Embase, and Web of Science were searched, and references of systematic reviews published in the past 3 years were reviewed. In PubMed, the Medical Subject Headings *pregnancy* and *infancy* were separately included with the combined terms of *pediatric overweight*, *childhood overweight*, *child overweight*, *children overweight*, *infancy overweight*, *pediatric obesity*, *childhood obesity*, *child obesity*, *children obesity*, *infancy obesity*, *pediatric obese*, *childhood obese*, *child obese*, *children obese*, and *infancy obese*.

Prospective, English-language studies were included if they had

1. human subjects;
2. original quantitative evidence;
3. exposure occurrence during the first 1,000 days; and
4. a main outcome measure of childhood overweight or obesity collected between age 6 months and 18 years, herein described as “overweight.”¹⁷⁻¹⁹

For age 2–18 years, studies reporting child BMI \geq 85th percentile for age and sex on 2000 CDC growth charts,¹⁷ BMI corresponding to adult BMI \geq 25 per International Obesity Task Force guidelines,¹⁸ or country-specific standards were included. For age 6 months and age 2 years, studies reporting child weight-for-length or BMI \geq 97.7th percentile on WHO charts and weight-for-length \geq 95th percentile on CDC growth charts were included.¹⁹ Because this review focuses on risk factors for child overweight, studies that only reported continuous

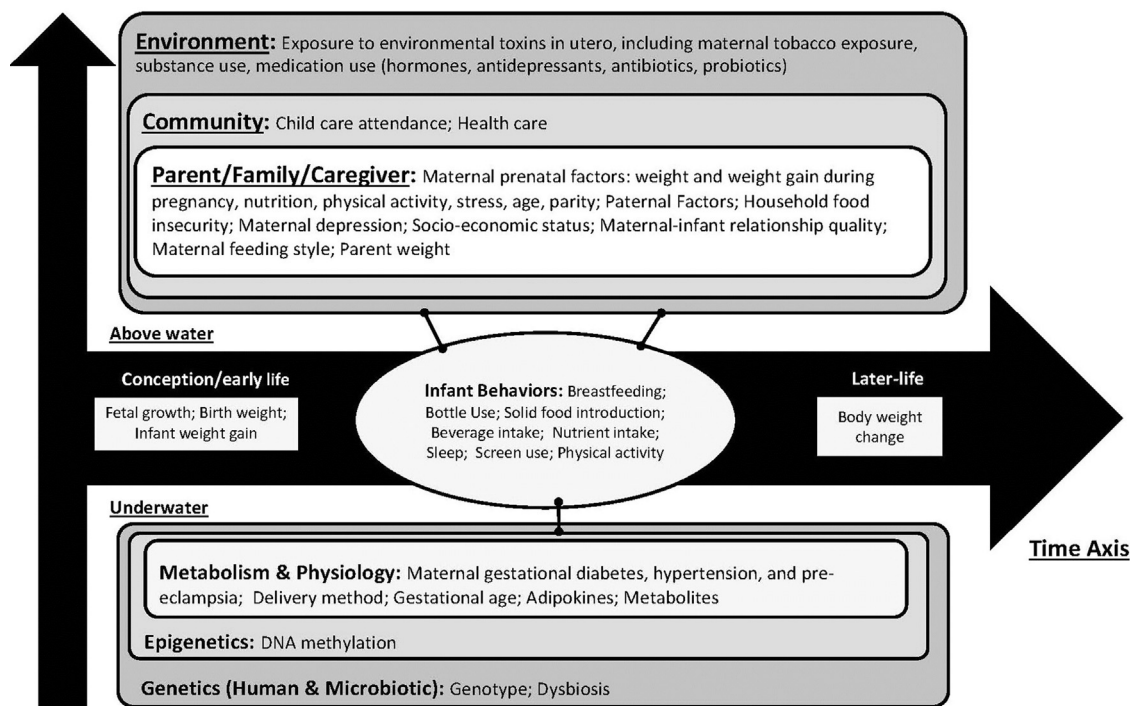


Figure 1. Conceptual framework for systematic review of childhood obesity risk factors from conception through age 2 years. Adapted from Glass and McAtee.¹⁴

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