

# Perioperative Adverse Respiratory Events in Overweight/Obese Children: Systematic Review

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*Childhood obesity is associated with numerous respiratory disorders, which may be aggravated when general anesthesia is administered. This systematic review aimed to investigate and synthesize the published literature on the associations between childhood obesity and perioperative adverse respiratory events (PAREs). By using key terms, observational studies published between 1990 and 2014 in English-language journals indexed by Cumulative Index for Nursing and Allied Health Literature, PubMed, Web of Science, Cochrane Database, and EMBASE were searched for reports of relevant associations. Nine articles were considered eligible for inclusion. In all studies, significant univariate and multivariate associations were reported between obesity and increased risk for PAREs in pediatric patients, mainly for hypoxemia, upper airway obstruction, and difficult mask ventilation. Appropriate strategies for preventing PAREs in obese children need to be followed by health care professionals. Multicenter studies are also recommended for ensuring high generalizability of reported associations and elucidating underlying mechanisms that link obesity to PAREs.*

**Keywords:** obesity, childhood, perioperative care, respiratory adverse events, systematic review.

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**EXCESSIVE BODY WEIGHT** in childhood constitutes an ongoing major public health concern. In the United States, obesity prevalence has increased from 7% in 1980 to 18% in 2012 in children ages 6 to 11 years, and from 5% to 21% in ages 12 to 19 years over the same period.<sup>1</sup> Likewise, in European countries, almost 20% of children and adolescents are overweight and 7% of them are obese, with the current annual rate increases being 10 times higher than those in the 1970s.<sup>2</sup> Considerable increases in childhood obesity prevalence have also been reported in developing countries.<sup>3</sup> In this context, the World Health Organization has identified the global epidemic of childhood obesity and has proposed recommendations for its control.<sup>4</sup> These recommendations are based on the preventable nature

of childhood obesity as more than 90% of cases are attributed to excessive calorie consumption along with low energy expenditure.<sup>5</sup>

Because body mass index (BMI) values substantially change with age, excessive weight disorders are determined by age-specific reference growth charts for BMI during childhood. Children are therefore classified as overweight, obese, or severely obese according to established reference percentiles.<sup>6,7</sup> Alternatively, centile curves passing through established cutoff points at the age of 18 years in BMI charts based on pooled international data have been suggested to provide less arbitrary definitions for overweight and obesity.<sup>8</sup> However, BMI use is limited by its inability to describe adiposity distribution (regional or overall).<sup>9</sup> Thus, considering that abdominal (central) obesity is associated with increased risk for pathologic conditions in childhood, indices of abdominal obesity, such as neck and waist circumference (WC), could be better predictors of adverse health consequences than BMI.<sup>9-11</sup>

Obese children and adolescents are prone to numerous comorbidities, which can be followed by medical complications and poor health status in adult life.<sup>12,13</sup> Respiratory comorbidity is the most common and includes bronchial hyper-reactivity and symptoms of severe asthma, increased risk for obstructive sleep apnea and obesity-hypoventilation syndrome, and impaired lung function indicated by decreased respiratory variables.<sup>14-17</sup> With regard to the upper airway, it can be narrowed by subcutaneous fat deposition on palatal and pharyngeal soft tissues along with fleshy cheeks and a large tongue. Obese children are also vulnerable to airway infections and gastroesophageal reflux.<sup>18,19</sup>

Perioperative adverse respiratory events (PAREs) have long been a primary safety concern for health care professionals because they can be followed by increased risk for cardiac arrest, prolonged hospital stay, and increased long-term mortality.<sup>20,21</sup> Despite difficulty in defining what a PARE entails, PAREs are more common in obese than normal weight adult surgical patients undergoing general anesthesia.<sup>22,23</sup> Considering that airway and respiratory complications are major causes of perioperative morbidity and

mortality in anesthetized children,<sup>24,25</sup> and that overweight/obese children represent an increasing proportion of surgical pediatric patients,<sup>26</sup> a crucial question is whether overweight/obese children could be more prone to PAREs. In this patient group, compromised airway and respiratory function, along with altered pharmacokinetics of drugs used in general anesthesia because of excessive weight can plausibly lead to complicated recovery and be followed by increased risk for PAREs.<sup>5,17,18</sup>

The purpose of this systematic literature review was to identify, appraise, and synthesize the existing empirical evidence on the association between overweight/obesity and the occurrence of PAREs in surgical pediatric patients receiving general anesthesia.

## Methods

### *Definition of Search Terms*

This systematic review was structured according to the guidelines set out in Preferred Reporting Items for Systematic reviews and Meta-Analyses statement.<sup>27</sup> To determine the eligibility of studies for inclusion in this review, the concepts of overweight/obesity in childhood and PAREs were defined. The following criteria were used for the exact definitions of overweight/obesity<sup>7-9</sup>:

- Overweight, obesity, and severe obesity for 85th < BMI < 95th percentile, BMI > 95th percentile, and BMI > 98th percentile, respectively;
- Overweight and obesity for BMI on or above the BMI curve passing through the 25 and 30 kg/m<sup>2</sup> cutoff point at age 18, respectively; and
- Abdominal obesity for WC > 90th percentile.

A PARE was defined as any major unanticipated airway or respiratory problem, which was generally identified by attending expert health care professionals and required physical or pharmacologic interventions. The following criteria were used for the exact definitions of PAREs<sup>28-31</sup>:

- Hypoxemia, defined as oxygen desaturation of arterial blood hemoglobin (<90% or lower);

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