PUBLIC HEALTH

What is a “high” prevalence of obesity? Two rapid reviews and a proposed set of thresholds for classifying prevalence levels

Tim Lobstein1,2 | Jo Jewell3

1Policy Section, World Obesity Federation, London, UK
2The Boden Group, University of Sydney, Sydney, New South Wales, Australia
3Nutrition Section, UNICEF, New York, New York, USA

Correspondence
Tim Lobstein, World Obesity Federation, London, UK.
Email: tlobstein@worldobesity.org

Funding information
UNICEF United Nations Children's Organization, Grant/Award Number: Consultancy to T Lobstein

Summary
Categories such as “low” and “high” have been used for several decades to describe the prevalence of stunting and wasting in populations of children aged under 5 years. They provide support for public health risk assessment and policy-making, including alerting health departments and aid agencies to national trends and local needs. In the light of the need for monitoring progress to meet globally agreed targets for overweight and obesity, the classification of their prevalence will be a valuable to aid in policy development, to target resources, and to promote public health interventions. This paper reviews the current use of categories to describe obesity prevalence in policy, advocacy, and research literature. Where prevalence categories have been formally proposed, this paper compares their application on large-scale datasets. The paper then develops a set of recommended threshold values to classify prevalence levels for overweight and obesity among children under age 5 years, children aged 5–19 years, and adults.

KEYWORDS
advocacy, intervention, prevalence threshold, risk assessment

1 | INTRODUCTION

Excess bodyweight in childhood affects more than 380 million children and adolescents,1 of whom the great majority, 82%, live in low- and middle-income countries (LMICs). In these countries, child overweight has risen rapidly: In just 6 years from 2010 to 2016, the estimated prevalence of overweight increased by 33% in Sub-Saharan Africa, 43% in Western Pacific, and 48% in South-East Asia.2

In 2013, members of the World Health Assembly agreed to work towards a target, by 2025, of a 25% reduction in mortality for NCDs and no increase in the prevalence of adult obesity or diabetes above 2010 levels.3 In 2015, the UN General Assembly adopted the 2030 Agenda for Sustainable Development4 with a suite of goals including, by 2030, reducing by one third of premature mortality from NCDs and ending “all forms of malnutrition.”

Among the many policy developments, in 2020, UNICEF and the World Health Organization (WHO) started piloting tools for strengthening country-level responses, assessing children’s nutritional status and the risk factors for overweight and obesity.5 The risk assessment tools include proposed classifications for the prevalence of obesity and overweight in terms of whether “low” or “high.” The present paper describes the process undertaken to define these classifications, reviewing the use of classification schemes and the rationale for the thresholds proposed.

1.1 | Current use of obesity prevalence categories

In order to understand better the descriptions of obesity and overweight prevalence levels used in the literature, a rapid review was
undertaken of published anthropometric surveys to assess how the descriptor “high” may be used to describe obesity prevalence.

2 | METHODS

2.1 | Prevalence surveys

The National Library of Science database (PubMed) was searched in early October 2020 for published papers using the word “high” associated with a report of obesity prevalence, published in the previous 25 years (September 1995 to September 2020). Of more than 30,000 titles returned, the first 200 “best match” were examined. Papers were excluded if they used comparators such as “higher than” and “not as high as” or did not report surveys of children's or adults' adiposity prevalence. Full text papers were examined by one author.

2.2 | Public health strategies

In a second survey, public health obesity strategy papers were examined for references to threshold values for obesity prevalence levels. A literature search was undertaken using Google and Google Scholar for documents describing obesity prevalence and sourced from government departments, intergovernmental agencies, and obesity professional societies (members of the World Obesity Federation). The first 200 returns were examined. Additional documents were examined based on the references cited in the retrieved documents and following contacts with authors (B Popkin and M Shekar). Papers were included if they defined the criteria used for classifying prevalence levels in population groups.

2.3 | Development of an expanded set of prevalence thresholds

In the analyses described below, the calculations of correlation coefficients use Pearson's product moment calculations, using the Microsoft Excel® “CORREL” function, and the calculation of regressions using the Microsoft Excel® scatterplot facility with the associated regression equation (linear regression unless otherwise stated). Scatterplot graphs are shown in the supporting information available online.

3 | RESULTS

3.1 | Prevalence surveys

Of the 200 “best match” records returned, 31 were excluded for using the term relatively (e.g., not as high, higher, and highest), 64 were excluded for using the term for comorbid conditions (e.g., high blood pressure and high risk of obstetric problems), and 14 were excluded for using the term to describe subjects or locations (e.g., high school, high income, and high mountain). The remaining 91 records were inspected by the first author and 50 of these were deliberately selected to demonstrate the range of prevalence levels and range of population samples where the term “high” was being used to describe obesity prevalence. The results are shown in Table 1, where it can be seen that the term is applied to a wide variety of prevalence levels, and based on several different criteria for defining overweight or obesity. The lowest levels of prevalence described as “high” were below 10% for adults and below 5% for children and adolescents. None of the papers referred to a published definition of “high,” and the use of the term “high” appeared to be based on the authors’ own judgments. These judgments may have been based on authors’ expectations: For example, in surveys of adults in LMICs, the word “high” was used for adult prevalence at levels as low as 6.8% in Nigeria and 5.2% in Malaysia. For children, “high” was used to describe levels of obesity prevalence below 10% in both low- and high-income countries, for example, 4.6% in India, 5% in Norway, 5.4% in Switzerland, and 3.9%–5.1% in Sweden, and the phrase “too high” was used to describe prevalence levels of 3.1%–4.4% among children in France.

3.2 | Public health strategies

Of 200 records returned by the searches, 130 records were excluded as not relating to obesity or related conditions (56 of the records), as social media links (24 records), advertising (43 records), and foreign language (5 records). Of the remaining 70 records, documents were downloaded and examined in detail. Of these, a further nine were found to be duplicates held on different sites, leaving 46 governmental and intergovernmental documents and 15 professional society documents included for examination. Documents in which the classification of prevalence levels for overweight or obesity were formally defined were examined and the source reference extracted. These source references were associated with four organizations, namely, the WHO together with UNICEF (cited 53 times),56,57 the World Bank58 linked to a paper by Popkin et al.59 (together cited 6 times), and the World Obesity Federation (cited 2 times).60,61 The details of the prevalence classifications are shown in Table 2. All papers use the same definitions for overweight and obesity, based on the WHO criteria.62 A fifth source, The 2020 Global Nutrition Report,63 stated in footnotes that the authors used a definition for “high” prevalence of overweight (including obesity) among adult women as being greater than 35%, but the document provides no source. This threshold is close to the definition used by the World Bank Group, shown in Table 2.

3.3 | Developing a uniform set of criteria

3.3.1 | Criteria for overweight prevalence among children under age 5 years

As noted, the purposes of classifying prevalence levels are to assist public health risk assessment, policy development and policy
| Source                              | Country                | Age group and adiposity definition                                                                 | Descriptor | Prevalence                      |
|------------------------------------|------------------------|---------------------------------------------------------------------------------------------------|------------|---------------------------------|
| Ajlouni et al. (2020)              | Jordan                 | Adults: obesity WC ≥94 for men and ≥80 for women                                                 | Alarmingly high | Men 60.4%; women 75.6%          |
| Al Junaibi et al. (2013)           | United Arab Emirates   | Children 6–19 years: obesity BMI > 95th centile (CDC)                                             | High       | 18.9%                           |
| Anwar et al. (2010)                | India                  | Children 11–14 years: obesity BMI > 97th centile (WHO)                                            | High       | 11.9%                           |
| Arroyo et al. (2000)               | Mexico                 | Adults: obesity BMI > 30                                                                          | High       | 21%                             |
| Bautista-Castano et al. (2011)     | Spain (Canaries)       | Adult pregnant women: obesity BMI > 30                                                            | High       | 17.1%                           |
| Berg et al. (2001)                 | Sweden                 | Young people 12–18 years: obesity BMI > 98th centile (UK90)                                       | High       | Boys 7.3–8.9%, girls 3.9–5.1%  |
| Castetbon (2015)                   | France                 | Children 5–15 years: obesity IOTF ≡ adult BMI > 30                                               | Too high   | 3.1%–4.4%                       |
| Chigbu et al. (2018)               | Nigeria                | Adults: obesity BMI > 30                                                                          | High       | 6.8%                            |
| Colmegna et al. (2016)             | Canada                 | Adults with rheumatoid arthritis: obesity BMI > 30                                                | High       | 34%                             |
| Coronado Vázquez et al. (2012)     | Spain                  | Children 6–14 years: obesity IOTF ≡ adult BMI > 30; obesity BMI > 95th centile (CDC)             | Very High  | IOTF: 11.6%; CDC: 16.5%         |
| De Pablos-Velasco et al. (2002)    | Spain (Canaries)       | Adults >30 years: obesity BMI > 30                                                                | Extremely high | Men 36.5%; women 23.6%          |
| del Río-Navarro et al. (2000)      | Mexico                 | Children 10–17 years: obesity IOTF ≡ adult BMI > 30; obesity BMI > 95th centile (CDC)            | High       | IOTF: Boys 11.6%, girls 9.5%    |
| Farsi and Elkhodary (2017)         | Saudi Arabia           | Adolescent boys mean age 16.5 years: obesity BMI > 95th centile (Saudi tables)                   | High       | 50.5%                           |
| Fernald et al. (2004)              | Mexico                 | Adults: obesity BMI > 30                                                                          | High       | Men 13.6%; women 22.2%          |
| Freitas et al. (2013)              | Brazil                 | Adults: Abdominal obesity WC > 94 for men and WC > 80 for women                                   | High       | 44.8%                           |
| Galfo et al. (2016)                | Italy                  | Adolescents 15–16 years: obesity IOTF ≡ adult BMI > 30                                           | High       | 7.9%                            |
| Ganie et al. (2017)                | India                  | Children 6–18 years: obesity BMI > 95th centile (CDC)                                             | High       | 4.6%                            |
| Gezawa et al. (2013)               | Nigeria                | Adults: obesity BMI > 30                                                                          | High       | 17.1%                           |
| Goday-Amor et al. (2013)           | Spain                  | Adults: obesity BMI 30–39.9                                                                       | High       | 14.5% (men 17.0%, women 7.7%)   |
| Gofin et al. (1996)                | Israel                 | Adults: obesity BMI > 30                                                                          | High       | Men 16%; women 33%              |
| Gopakrishnan et al. (2012)         | Malaysia               | Adult students 19–25 years: obesity BMI > 30                                                      | High       | 5.2%                            |
| Grammatikopoulou et al. (2013)     | Greece                 | Adult pregnant women: obesity BMI > 30                                                             | High       | 25.6%                           |
| Grol et al. (1997)                 | Curacao                | Adults: obesity BMI > 30                                                                          | Alarmingly high | Men 19%; women 36%              |
| Grujic et al. (2009)               | Serbia                 | Adults: obesity BMI > 30                                                                          | High       | Men 20.2%; women 23.1%          |
| Hedley et al. (2004)               | USA                    | Children 6–19 years: overweight BMI > 95th centile (CDC); adults: obesity BMI > 30               | High       | Children 16.0%; adults 30.4%    |
| Herlevic et al. (2015)             | USA                    | Adult women: obesity BMI > 30                                                                     | High       | 55%                             |
| Ichinohe et al. (2005)             | Jamaica                | Adult women: obesity BMI > 30                                                                     | Very high  | 23.9%                           |
| Isasi et al. (2011)                | USA                    | Children 11–18 years: obesity BMI > 95th centile (CDC)                                            | High       | 22.5%                           |
| Source                          | Country       | Age group and adiposity definition                                                                 | Descriptor | Prevalence                          |
|--------------------------------|---------------|---------------------------------------------------------------------------------------------------|------------|-------------------------------------|
| Jiang et al. (2014)35          | China         | Children 8–15 years: obesity IOTF ≡ adult BMI > 27 [and ≡ adult BMI > 30]                          | High       | Boys 19.8%; girls 8.4% [boys 7.9%; girls 2.7%] |
| Johnson-Down et al. (1997)36   | Canada        | Children 9–12 years: obesity IOTF ≡ adult BMI > 27 [and ≡ adult BMI > 30]                          | High       | 19.4%                               |
| Kokkvoll et al. (2012)37       | Norway        | Children 6 years: obesity IOTF ≡ adult BMI > 30                                                  | High       | 5%                                  |
| Ledegerber and Steffen (2011)38| Switzerland   | Children 5–16 years: IOTF ≡ adult BMI > 30                                                        | High       | 5.4%                                |
| Malik and Bakir (2007)39       | United Arab Emirates | Children 5–17 years: overweight IOTF ≡ adult BMI > 25                                         | High       | 21.5%                               |
| Mkuu et al. (2018)40           | Kenya         | Adult women: obesity BMI > 30                                                                    | High       | 9.1%                                |
| Nafiu et al. (2007)41          | USA           | Children 2–18 years: obesity BMI > 95th centile (CDC 2000)                                        | High       | 17.2%                               |
| Nathell et al. (2002)42        | Sweden        | Adults with asthma: obesity BMI > 30                                                              | High       | 20.7%                               |
| Nguyen et al. (2013)43         | Vietnam       | Children 11–14 years: overweight IOTF ≡ adult BMI > 25                                             | High       | Boys 22.0%; girls 13.3%             |
| O’Neill et al. (2007)44        | Ireland       | Children 5–12 years: overweight IOTF ≡ adult BMI > 25                                             | High       | CDC: 10.7%; UK90: 11.2%; IOTF: 7.2%  |
| Padez et al. (2004)45          | Portugal      | Children 7–9 years: obesity IOTF ≡ adult BMI > 30                                                | High       | 11.3%                               |
| Papadimitriou et al. (2006)46  | Greece        | Children 6–11 years: obesity IOTF ≡ adult BMI > 30                                                | High       | Boys 12.3%; girls 9.9%              |
| Papadimitriou et al. (2008)47  | Greece        | Adult men 19–26 years: obesity BMI > 30                                                           | Alarmingly high | 10.4%                             |
| Pedrosa et al. (2011)48        | Portugal      | Children 7–9 years: obesity IOTF ≡ adult BMI > 30; and BMI > 98th centile (CDC)                   | High       | IOTF: 8.1%; CDC: 14.0%              |
| Preston et al. (2015)49        | Peru          | Children 7–8 years: obesity BMI > 2sd (WHO)                                                      | High       | 8.6%                                |
| Ruangkwanasator et al. (2014)50 | Thailand      | Adults: “obesity” BMI > 25                                                                       | High       | 39.7%                               |
| Salimi et al. (2019)51         | Iran          | Adults: obesity BMI > 30                                                                         | High       | 13%                                 |
| Somasundaram et al. (2019)52   | Sri Lanka     | Adults: obesity BMI > 30                                                                         | High       | 15.8%                               |
| Stewart et al. (2009)53        | Scotland UK   | Children mean age 13.3 years: obesity BMI > 95th centile (UK90)                                   | High       | 36%                                 |
| Vražić et al. (2012)54         | Croatia       | Adults: obesity BMI > 30                                                                         | High       | 28.6%                               |
| Yumuk et al. (2005)55          | Turkey        | Adults: obesity BMI > 30                                                                         | High       | 23.7%                               |

**Abbreviations:** BMI, body mass index (in kilograms per meter squared); CDC 2000, US Centers for Disease Control and Prevention 2000 growth reference tables; IOTF, International Obesity Task Force growth reference tables; NHANES II, US National Health and Nutrition Examination Survey 1990 growth reference tables; UK90, United Kingdom 1990 growth reference tables; WC, waist circumference (in centimeters); WHO, World Health Organization 2007 growth reference tables.
The question arises as to what validation measures can be used to justify a preference for one classification scheme over another. The paper by de Onis et al. uses prevalence categories defined and widely accepted for wasting and applies them to overweight, on the basis that both measures are at either end of the same distribution continuum (i.e., weight for length or height). De Onis et al. also justify their criteria by showing that the range of values for national prevalence found in 128 countries reporting up to 2017 are similar for wasting (range: 0.1% to 22.4%) as they are for overweight (range: 0.1% to 26.5%). This might change according to the success or failure of policies to tackle malnutrition, but the updated figures for 2021, expanded to 155 countries, show prevalence ranging from 0.0% to 22.7% for wasting and 1.3% to 25.4% for overweight, indicating

### TABLE 2 Prevalence classifications and thresholds proposed by four sources

| Children under 5 years | World Health Organization/UNICEF World Bank Group Popkin et al. World Obesity Federation |
|-------------------------|---------------------------------------------------------------|
| Very low                | <2.5%                                                         |
| Low                     | 2.5% to <5%                                                   |
| Medium                  | 5% to <10%                                                    |
| High                    | 10% to <15%                                                   |
| Very high               | ≥15%                                                          |

| Older children and adolescents 5–19 years | World Bank Group Popkin et al. World Obesity Federation |
|------------------------------------------|---------------------------------------------------------------|
| Very low                                | <10%                                                         |
| Medium                                  | 10% to <15%                                                   |
| High                                    | 15% to <20%                                                   |
| Very high                               | ≥20%                                                          |

| Adults | World Bank Group Popkin et al. World Obesity Federation |
|--------|---------------------------------------------------------------|
| Very low | <20%                                                         |
| Medium   | 20% to <30%                                                   |
| High     | 30% to <40%                                                   |
| Very high | ≥40%                                                          |

### TABLE 3 Distribution of countries' prevalence of overweight in children under age 5 years, for 2017 and 2021 classified according to de Onis et al. 2019

| WHO classification | Prevalence | 2017 De Onis et al. Number of countries | 2021 UNICEF/WHO/World Bank Number of countries |
|---------------------|------------|------------------------------------------|-----------------------------------------------|
| Very low            | <2.5%      | 18                                       | 14%                                           |
| Low                 | 2.5% to <5%| 33                                       | 26%                                           |
| Medium              | 5% to <10% | 50                                       | 39%                                           |
| High                | 10% to <15%| 18                                       | 14%                                           |
| Very high           | ≥15%       | 9                                        | 7%                                            |

Abbreviation: WHO, World Health Organization.
that a similar equality of distribution has been maintained in the most recent years and applies across a greater number of countries. Within each classification, the proportion of countries has also remained consistent in the most recent years, as shown in Table 3.

It can also be argued that the definition of a “very low” prevalence of overweight at a threshold of 2.5% of the population has some external validation, given that a population of healthy children used by WHO to represent optimum growth defines overweight at a threshold of weight-for-height Z score above +2.0, equivalent to 2.3% of the population.65

Given these arguments, the de Onis et al. classification scheme was adopted for the joint WHO–UNICEF 2019 publication Recommendations for data collection, analysis and reporting on anthropometric indicators in children under 5 years old.57 As Table 2 shows, the WHO–UNICEF classification scheme is not identical to that suggested by either the World Bank or the paper by Popkin et al. Table 4 compares the distribution of prevalence classifications using the WHO–UNICEF criteria and the World Bank Group criteria, for the 155 countries reported in the 2021 Joint Malnutrition Estimates.64

Under the World Bank categorization, 81% of countries are classified with a “low” prevalence of overweight, and less than 5% of countries with a “high” or “very high” prevalence, and this is similar to the Popkin et al. scheme which would classify 99% of countries as having less than a “medium” prevalence of overweight. This suggests that the discriminatory power of either of these two classification schemes may be relatively weak for distinguishing countries, and from a public health perspective, they may lead to many countries assuming that obesity prevalence and 12% “very high” obesity prevalence (Table S1). Although there are many reasons why overweight in under-5s may not translate into obesity in children 5–19 years, a linear correlation between the two prevalence estimates for 152 countries (the countries where both estimates are available) is statistically significant ($r = 0.42, p < 0.001$).

### 3.3.2 | Criteria for obesity prevalence among children aged 5–19 years

The classification of overweight prevalence among children under 5 years can be used as a basis for developing threshold criteria for categorizing obesity in older children. The WHO defines obesity in older children and adolescents (age 5–19 years) as having a body mass index (BMI) Z score above +2.0, compared with a reference population. In the case of BMI distribution, the same logic can be followed, with <2.5% being the threshold for “very low” as again there would be an expected 2.3% of children to have a BMI above a Z score of +2.0 in a healthy population for this age range. Applying the same classification scheme used for children under age 5 years to children aged 5–19 years, the distribution of prevalence levels for 191 countries provided in the WHO Global Health Observatory66 shows 14% of countries to have “very low” obesity prevalence and 12% “very high” obesity prevalence (Table S1). Although there are many reasons why overweight in under-5s may not translate into obesity in children 5–19 years, a linear correlation between the two prevalence estimates for 152 countries (the countries where both estimates are available) is statistically significant ($r = 0.42, p < 0.001$).

### 3.3.3 | Criteria for obesity prevalence among adults

The next step moves from child to adult prevalence. A very high correlation ($r = 0.91, p < 0.001$) is found between child and adolescent (ages 5–19 years) obesity prevalence and age-adjusted adult obesity prevalence, across 192 countries in the WHO Global Health Observatory’s 2016 estimates.67 The regression equation ($y = 0.51x – 1.20$) indicates that adult obesity prevalence is found at approximately twice the levels found in children and adolescents (see Figure S1). On this basis, it is reasonable to suggest categories for adults based on double the prevalence thresholds for children aged 5–19 years.

However, based on the regression equation, the equivalent figure for 10% prevalence in children is around 23% for adults. This could be rounded to 20% prevalence or 25% prevalence. There is no obvious method for externally validating one alternative over the other, so it is suggested here that the threshold of 20% rather than 25% is used as the recommended threshold to define a “high” prevalence. It should be recalled that very few countries had obesity prevalence levels as high as 20% only a generation ago. A comparison of the two options showing the distribution of countries across the classifications is shown in Table S2. The proposed criteria for adult obesity are shown in Table 7.

### 3.3.4 | Criteria for prevalence of “at risk of overweight” in children under age 5 years

Children under age 5 years with a weight-for-length/height Z score between +1.0 and +2.0 are classified as “at risk of overweight” (“at risk”) by the WHO, equivalent to a prevalence between 2.3% at $Z = +2.0$ and 16% at $Z = +1.0$ in the population of children with optimum health. In order to propose prevalence categories for “at-risk” children, the data for the prevalence of children “at risk” were regressed against the prevalence of children overweight, based on the dataset provided
by de Onis et al. in 2010, which provides prevalence figures from 979 surveys in which both “at-risk” and overweight prevalence values were provided (including repeated surveys over several years).68

The surveys were generally in low- and lower-middle-income countries, so the number of countries with higher prevalence levels may have been limited. The results show a good correlation between “at-risk-of-overweight” and overweight prevalence levels ($r = 0.71, p < 0.001$) and a regression line close to 0.5 ($y = 0.52x – 0.73$) (see Figure S2), indicating that it would be reasonable to use criteria for “at-risk-of-overweight” children at around double those for overweight children in this age group. Using latest available data from each of the 123 different countries gave a distribution in which 23% of countries had a low or very low prevalence of children “at risk of overweight” and 29% of countries had a high or very high prevalence of children “at risk” (see Table S3). Based on the “at-risk of overweight” and overweight in combination (i.e., the prevalence of children with weight-for-height $Z$ scores $> +1.0$), 27% of countries had a low or very low prevalence, and 31% of the countries had a high or very high prevalence (see Table S3).

### 3.3.5 | Criteria for prevalence of overweight in children 5–19 years

Using the same approach for overweight (without obesity) in older children (defined as having a BMI $Z$ score between $+1.0$ and $+2.0$ above the median reference population), the prevalence for overweight regressed against that for obesity in this age group, based on 191 countries reported in the WHO Global Health Observatory, shows a strong correlation ($r = 0.88, p < 0.0001$) and a linear gradient of over 0.9 and an offset of 5 percentage points ($y = 0.93x – 5.20$) (see Figure S3). This indicates that the corresponding classifications of prevalence, rounded to convenient levels, can be proposed at 5 percentage points above those for obesity and are shown in Table 7. Of 191 countries, 6% have a “very low” prevalence of overweight children and adolescents, and 16% a “very high” prevalence (see Table S4).

Combining overweight with obesity, the distribution of prevalence levels for all children above a BMI $Z$ score of $+1.0$ shows 7% of countries to have a very low prevalence of overweight including obesity and 14% to have a very high prevalence of overweight including obesity.

The present proposals were compared with those of the World Bank58 and the Popkin et al.59 paper, which also suggest criteria for prevalence levels for this group of children. The results are shown in Table 5. The World Bank classification scheme appears skewed towards identifying nearly two thirds of countries as having a “very high” prevalence of overweight and obesity. Setting a target for improvement (e.g., bringing the prevalence down to Medium) may be hard to achieve for many of these countries. The Popkin et al.59 classification scheme looks less distorted, although nearly 40% of countries are classified as having prevalence levels below “Medium,” which may deter those countries from taking action to prevent child and adolescent overweight from increasing.

### 3.3.6 | Criteria for overweight prevalence in adults

Lastly, the categorization of the prevalence of overweight in adults can be proposed. A scatterplot of adult overweight, nonobese prevalence against adult obesity prevalence shows some nonlinearity, which is primarily explained by outliers (mostly in the Pacific Islands) where the mean BMI is above 30 kg/m$^2$ (see Figure S4). A linear regression shows a strong correlation ($r = 0.67, p < 0.0001$) and a gradient of close to 1 with an offset close to 10 percentage points ($y = 1.0864x – 11.584$; see Figure S4). This indicates the rounded thresholds shown in Table 7. [Note that excluding the high BMI outliers and regressing overweight on obesity prevalence only for those countries where obesity prevalence is below 45% gives a correlation of $r = 0.87 (n = 181; p < 0.001)$ and a gradient just over 1 and an offset of 12.4, which would make little difference to the proposed thresholds.]

Table 5 shows the distribution of 191 countries for the prevalence of overweight nonobesity in adults: 18% of countries are classified with a very low or low level of overweight nonobesity in adults, and 58% of countries have a high or very high level of overweight nonobesity in adults. The figures increase marginally to 23% and 59% of countries respectively when overweight and obesity are combined (i.e., prevalence of all adults with BMI $> 25$ kg/m$^2$).

---

**Table 5** Distribution of 191 countries’ prevalence levels for overweight and obesity combined for children (aged 5–19 years), comparing proposed classification thresholds, and those of the World Bank Group and Popkin et al.

| Proposed classifications | Country distribution | World Bank classifications | Country distribution | Popkin et al. classifications | Country distribution |
|--------------------------|----------------------|---------------------------|----------------------|-----------------------------|----------------------|
| Very low <10%            | 7%                   |                           |                      |                             |                      |
| Low 10% to <15%          | 22%                  | Low <10%                  | 7%                   | (Up to 20%)                 | 37%                  |
| Medium 15% to <25%       | 22%                  | Medium 10% to <15%        | 22%                  | Medium >20%                 | 36%                  |
| High 25% to <35%         | 35%                  | High 15% to <20%          | 8%                   | High >30%                   | 21%                  |
| Very high ≥35%           | 14%                  | Very high ≥20%            | 63%                  | Very high >40%              | 6%                   |
| **N = 191**              |                      |                           |                      |                             |                      |

Source: World Health Organization Global Health Observatory.
Table 6 shows the distribution for countries using the proposed thresholds for overweight prevalence (including obesity) and compares these with the distributions under the proposed schemes from the World Bank\textsuperscript{58} and Popkin et al.\textsuperscript{59} The latter two classifications schemes are identical, and both would classify two thirds of the world’s countries as having a very high prevalence of overweight and obesity combined.

### 4 | DISCUSSION

The prevalence of undernutrition has been classified since the early 1990s for global monitoring of malnutrition in children under age 5 years. The original threshold level for wasting—the “severity index for malnutrition in emergency situations”—is based on the association of prevalence levels with mortality risk.\textsuperscript{56} Following the publication of the WHO Child Growth Standards in 2006, and the inclusion of child and adolescent overweight and obesity in the 2014 publication Global Nutrition Targets 2025, the WHO and UNICEF proposed a set of thresholds for overweight prevalence for the assessment of anthropometric surveys of children under 5 years old.\textsuperscript{57} These joint WHO/UNICEF thresholds are used to define prevalence levels as very low, low, medium, high, and very high.

Prevalence thresholds are used to guide public health intervention policies for communicable diseases as a means of assisting decision-makers on when it is justified to take population-level action (e.g., in the case of malaria\textsuperscript{69} or HIV\textsuperscript{70}) and have been used for risk assessment purposes for several years to plan undernutrition interventions. Their use can now be extended for interventions aiming to reduce the risk of overweight and obesity in populations, by alerting health departments and aid agencies to national trends and local needs, by demonstrating progress in policy implementation, and by improving popular understanding of nutrition issues. Prevalence categories can be used to compare countries and their progress towards achieving the World Health Assembly and Sustainable Development Goals for nutrition and can be used by professional organizations to argue the case for strengthening policies to tackle overweight and obesity (an example is the “traffic-light” coding of childhood obesity levels in the World Obesity Federation report \textit{Atlas of Childhood Obesity},\textsuperscript{60} and the same organization’s categorization of adult obesity levels in their report \textit{Obesity: missing the 2025 global targets}.\textsuperscript{61}). In the publications by the World Bank Group\textsuperscript{58} and Popkin et al.,\textsuperscript{59} prevalence categories for child and adult overweight are used in conjunction with measures of undernutrition to demonstrate the dynamics of the double burden of malnutrition, especially in LMICs, and the associated changes in food systems and physical activity that can be identified.

The analyses presented here have led the authors to recommend a set of threshold values for the prevalence of overweight and obesity in populations, presented in Table 7. The thresholds are grounded on the proposals of de Onis et al.\textsuperscript{56} for children under age 5 years used by the WHO and UNICEF and the approach extended by regression analyses to suggest thresholds for categorizing prevalence levels for young children “at risk of overweight” and also to older children and adults, both for obesity prevalence and for overweight prevalence. The proposed classification thresholds are shown in Table 7.

The proposed categorizations show many countries in the “high” and “very high” categories: For example, 21% of countries have “high” or “very high” overweight prevalence in children under 5 years, rising to 39% of countries with “high” or “very high” prevalence of obesity in children 5–19 years, and rising further to 55% of countries classified with “high” or “very high” adult obesity prevalence levels.

### 4.1 | Limitations

Some care may need to be taken in the use of these thresholds for defining categories of prevalence. Comparisons between countries should be treated carefully, as estimates may be based on different time periods, different subpopulations, different types of survey and measurement methods, or different schemes for defining overweight and obesity. The thresholds proposed here are suggested as covering low-income, middle-income, and higher income countries, and across different ethnic and racial groupings, using body mass index (BMI) as the indicator of weight status. Arguments can be made for different thresholds for classifying prevalence in population subgroups or based on different measurement methods for assessing overweight. It should be noted that both the World Bank Group and the Popkin
et al. proposals were primarily intended for LMICs, whereas de Onis et al. did not specify countries where the classification for under-5s would or would not apply.

Users of prevalence surveys will be aware that populations are constantly in flux and the prevalence levels found in a given survey may lead to a prevalence definition that does not reflect changing circumstances, especially in countries experiencing nutrition transitions or rapid population change. As with many public health measurements, the direction of change over time is as important as the measurement in any one instance.

The methods used in developing the present proposals rely on sets of surveys and estimated prevalence levels published since 2010, and on the use of linear regressions to determine the relation between prevalence levels found in younger age groups and those found in older age groups. Other datasets or alternative means of determining the relationships may have given different results.

The proposed set of thresholds and categories in Table 7 have been applied across the different methods for assessing childhood overweight (developed by WHO, by the US CDC, and by the International Obesity Task Force [IOTF]) without differential analyses. The three approaches do not provide identical estimates of the prevalence of overweight or obesity, and it is possible that the classifications proposed here may not be suitable for surveys using the CDC or IOTF criteria. This remains to be assessed, but for the present, the three approaches have been treated as sufficiently similar to allow the same classification scheme to be applied.

Lastly, as has been noted earlier, there is no external validation for the thresholds and categories proposed here for older children and adults. They are extensions of the approach taken for children under age 5 years, which was linked to the expected prevalence for a healthy population (using Z scores) and was internally symmetrical for the proportions of countries in the lowest and highest categories. External validity will depend on the functional value of the thresholds and categories as they are used in practice.

## 5 Conclusion

A formal set of criteria for describing and classifying prevalence levels can be of value for policy development and public communication.
As the paper by de Onis et al. \(^{56}\) concluded, “Harmonized terminology will help avoid confusion and promote appropriate interventions” (p. 175). A review of the use of the descriptor “high” for the prevalence of overweight or obesity found it has been used by researchers somewhat indiscriminately. The present paper proposes a set of threshold values for defining overweight and obesity prevalence in a population as “low,” “medium,” “high,” and so forth based on the approach used by the WHO for children under age 5 years and extended to children aged 5–19 years, and to adults.

As this paper goes to press, these thresholds are being used in a pilot version of the UNICEF–WHO Landscape Analysis tool being applied in several countries in 2020–2021. \(^{5}\) The recommended threshold values are also expected to be used in future editions of the World Obesity Federation’s Obesity Atlas series.

**ACKNOWLEDGMENT**

The first author is grateful for the support of a consultancy with World Obesity Federation’s threshold values are also expected to be used in future editions of the World Obesity Federation’s Obesity Atlas series.

**CONFLICT OF INTEREST**

The authors declare no conflict of interests in this work.

**ORCID**

Tim Lobstein  https://orcid.org/0000-0003-4102-0545

**REFERENCES**

1. World Health Organization. Global Health Observatory Online Database Table BMIPLUS1CWBv. Geneva: WHO; 2021.
2. World Health Organization and World Obesity Federation. Taking Action on Childhood Obesity. Geneva: WHO; 2018.
3. World Health Organization. Global Action Plan for the Prevention and Control of NCDs 2013–2020. Geneva: WHO; 2013.
4. United Nations. Sustainable Development Goals Knowledge Platform. Transforming Our World: The 2030 Agenda for Sustainable Development. New York: United Nations; 2019.
5. UNICEF/WHO. Landscape Analysis Tool on Overweight and Obesity in Children and Adolescents, Pilot Version (October 2020). New York, NY: UNICEF; 2020. https://nnc.gov.ph/phocadownload/pap/Dissemination_Forum_of_Results_of_Studies_on_Overweight_and_Obesity/Presentation%20on%20NCNP_Landscape%20Analysis_Ow_Ob_World%20Obesity%20Day_04March2021.pdf and http://iegindia.in/upload/project_studies/250621_1453128repWil20.pdf
6. Aljouni K, Khader Y, Batieha A, Jaddou H, El-Khatib M. An alarmingly high and increasing prevalence of obesity in Jordan. Epidemiol Health. 2020;42:e2020040.
7. Al Junabi A, Abdulla A, Sabri S, Hag-Ali M, Nagelkerke N. The prevalence and potential determinants of obesity among school children and adolescents in Abu Dhabi, United Arab Emirates. Int J Obes (Lond). 2013;37(1):68-74.
8. Anwar A, Anwar F, Jioya HU, et al. Prevalence of obesity among the school-going children of Lahore and associated factors. J Ayub Med Coll Abbottabad. 2010;22(4):27-32.
9. Arroyo P, Loria A, Fernández V, et al. Prevalence of pre-obesity and obesity in urban adult Mexicans in comparison with other large surveys. Obes Res. 2000;8(2):179-185.
10. Bautista-Castaño I, Alemán-Perez N, García-Salvador JJ, González-Quesada A, García-Hernández JA, Serra-Majem L. Prevalence of obesity in pregnant women of Canary Islands, Spain. Med Clin (Barc). 2011;136(11):478-480.
11. Berg IM, Simonsson B, Brantefor B, Ringqvist I. Prevalence of overweight and obesity in children and adolescents in a county in Sweden. Acta Paediatr. 2001;90(6):671-676.
12. Castetbon K. Recent prevalence of child and adolescent overweight and obesity in France and abroad. Arch Pediatr. 2015;22(1):111-115.
13. Charo L, Lacoursiere DY. Introduction: obesity and lifestyle issues in women. Clin Obstet Gynecol. 2014;57(3):433-445.
14. Chibgu BO, Parhofer KG, Aniebue UU, Berger U. Prevalence and sociodemographic determinants of adult obesity: a large representative household survey in a resource-constrained African setting with double burden of undernutrition and overweight. J Epidemiol Community Health. 2018;72(8):702-707.
15. Colmegna I, Hitchen CA, Bardales MC, Puri L, Bartlett SJ. High rates of obesity and greater associated disability among people with rheumatoid arthritis in Canada. Clin Rheumatol. 2016;35(2): 457-460.
16. Coronado Vázquez V, Odero Sobrado D, Canalejo González D, Cidoncha Pérez J. Prevalence of overweight and obesity in schoolchildren in rural areas. Gac Sanit. 2012;26(3):460-462.
17. De Pablos-Velasco PL, Martínez-Martín FJ, Rodríguez-Pérez F. Prevalence of obesity in a Canarian community. Association with type 2 diabetes mellitus: the Guía Study. Eur J Clin Nutr. 2002;56(6): 557-560.
18. del Rio-Navarro BE, Velázquez-Monroy O, Sánchez-Castillo CP, et al. The high prevalence of overweight and obesity in Mexican children. Obes Res. 2004;12(2):215-223.
19. Farsi DJ, Elkhodary HM. The prevalence of overweight/obesity in high school adolescents in Jeddah and the association of obesity association with dental caries. Ann Saudi Med. 2017;37(2): 114-121.
20. Fernald LC, Gutierrez JP, Neufeld LM, et al. High prevalence of obesity among the poor in Mexico. JAMA. 2004;291(21): 2544-2545.
21. Freitas AT, Vaz IM, Ferraz SF, Peixoto Mdo R, Campos MI, Formés NS. Prevalence and associated factors with abdominal obesity in hemodialysis patients in Goiânia—GO. J Bras Nefrol. 2013;35(4): 265-272.
22. Galfo M, D’Addezio L, Censi L, Roccaldo R, Martone D. Overweight and obesity in Italian adolescents: examined prevalence and socio-demographic factors. Cent Eur J Public Health. 2016;24(4): 262-267.
23. Ganie MA, Bhat GA, Wani IA, et al. Prevalence, risk factors and consequences of overweight and obesity among schoolchildren: a cross-sectional study in Kashmir, India. J Pediatr Endocrinol Metab. 2017;30(2):203-209.
24. Gezza AM, Puepet FH, Mubi BM, et al. Prevalence of overweight and obesity in Maiduguri, North-Eastern Nigeria. Niger J Med. 2013; 22(3):171-174.
25. Goday-Arnó A, Calvo-Bonacho E, Sánchez-Chaparro MA, et al. High prevalence of obesity in a Spanish working population. Endocrinol Nutr. 2013;60(4):173-178.
26. Gofin J, Abramson JH, Kark JD, Epstein L. The prevalence of obesity and its changes over time in middle-aged and elderly men and women in Jerusalem. Int J Obes Relat Metab Disord. 1996;20(3): 260-266.
27. Gopalakrishnan S, Ganeshkumar P, Prakash MV, Amalraj V. Prevalence of overweight/obesity among the medical students, Malaysia. Med J Malaysia. 2012;67(4):442-444.
28. Grammatikopoulou MG, Pritsa AA, Badeka S, et al. A pilot study on the prevalence of maternal obesity in selected Greek counties. Endocrinol Nutr. 2013;60(9):507-512.
29. Grol ME, Eimers JM, Alberts JF, et al. Alarmingly high prevalence of obesity in Curacao: data from an interview survey stratified for socioeconomic status. Int J Obes Relat Metab Disord. 1997;21(11):1002-1009.

30. Grujić V, Cvejin MM, Nikolić EA, et al. Association between obesity and socioeconomic factors and lifestyle. Vojnosanit Pregl. 2009;66(9):705-710.

31. Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999–2002. JAMA. 2004;291(23):2847-2850.

32. Herlevic VC, Mowad R, Miller JK, Darentsburg NA, Li BD, Kim RH. Breast cancer outcomes in a population with high prevalence of obesity. J Surg Res. 2015;198(2):371-376.

33. Ichinohara M, Mita R, Saito K, et al. The prevalence of obesity and its relationship with lifestyle factors in Jamaica. Tohoku J Exp Med. 2005;207(1):21-32.

34. Isasi CR, Whiffen A, Campbell E, Florez Y, Freeman K, Wylie-Rosett J. Prevalence of overweight and obesity among inner-city adolescent boys in the city of Basel (Switzerland). Eur J Clin Nutr. 2012;66(Suppl 2):S10-29.

35. Jiang XX, Hardy LL, Baur LA, Ding D, Wang L, Shi HJ. Prevalence of overweight and obesity among 11- to 20-year-old Chinese adolescents from 1979 to 2011: a systematic review and meta-analysis. Int J Obes Relat Metab Disord. 2015;39(10):1417-1428.

36. Johnson-Down L, O’Loughlin J, Koski KG, Gray-Donald K. High prevalence of overweight and obesity in ambulatory children and adolescents with intellectual disability. J Intellect Disabil Res. 2009;53(10):823-827.

37. Kokkvoll A, Jeppesen E, Juliusson P, Flagestad T, Njølstad I. High prevalence of overweight and obesity among 6-year-old children in Finnmark County, North Norway. Acta Paediatr. 2012;101(9):924-928.

38. Ledergerber M, Steffen T. Prevalence of overweight and obesity in children and adolescents from 1977 to 2009—examination of the school medical data of more than 94,000 school-age children in the city of Basel (Switzerland). Gesundheitswesen. 2011;73(1):46-53.

39. Malik M, Bakir A. Prevalence of overweight and obesity among children in the United Arab Emirates. Obes Rev. 2007;8(1):15-20.

40. Mkoua R, Epnere K, Chowdhury MAB. Prevalence and predictors of overweight and obesity among young men. Preve Chron Dis. 2018;15:E44.

41. Nafiu OO, Ndao-Brumlay KS, Bamgbade OA, Morris M, Kassim MA, Al-Mustafa H. Prevalence of overweight and obesity in a U.S. pediatric surgical population. J Pediatr Surg. 2007;42(1):178-182.

42. Nafsouli T, Brinsden H. Atlas of Childhood Obesity. London: World Obesity Federation; 2019.

43. Pedraza C, Correa F, Seabra D, Oliveira BM, Simões-Pereira C, Vaz-de-Almeida PD. Prevalence of overweight and obesity among 7–9-year-old children in Aveiro, Portugal: comparison between IOTF and CDC references. Public Health Nutr. 2011;14(1):14-19.

44. Preston EC, Ariana P, Penny ME, Frost M, Plugg E. Prevalence of childhood overweight and obesity and associated factors in Peru. Rev Panam Salud Publica. 2015;38(6):472-478.

45. Ruanpickananchasanet P, Sattrapoj B, Bunag N, Vongviswanath A, Premasathian N, Avihingsanon Y. High prevalence of obesity in Thai renal transplant recipients: a multicenter study. Transplant Proc. 2014;46(2):546-551.

46. Salimi Y, Taghdir M, Sepandi M, Karimi Zarchi AA. The prevalence of overweight and obesity among Iranian military personnel: a systematic review and meta-analysis. BMC Public Health. 2019;19(1):162.

47. Shekar M, Popkin B (Eds). Obesity: Health and Economic Consequences of an Impending Global Challenge. Human Development Perspectives Series. Washington, DC: World Bank; 2020.

48. Shekar M, Popkin B (Eds). Obesity: Health and Economic Consequences of an Impending Global Challenge. Human Development Perspectives Series. Washington, DC: World Bank; 2020.

49. Shigematsu Y, Kurtzke JF, Marchi LM, et al. Association between obesity and multiple sclerosis. Mult Scler. 2019;25(5):613-619.

50. Solomon CG, Landay AL, Landay AL, et al. Use of obesity and overweight definitions in the United States: a systematic review and meta-analysis. Am J Public Health. 2016;106(12):2260-2271.

51. Stöckli EA, et al. The prevalence of overweight and obesity among 6–9-year-old children in Aveiro, Portugal: comparison between IOTF and CDC references. Public Health Nutr. 2011;14(1):14-19.

52. Stoltenberg M, Stoltenberg M, Stoltenberg M, Stoltenberg M, Stoltenberg M. Prevalence of overweight and obesity among inner-city adolescent boys in the city of Basel (Switzerland). Gesundheitswesen. 2011;73(1):46-53.

53. Stoudemire KG, Turek C, et al. Prevalence of overweight and obesity among inner-city adolescent boys in the city of Basel (Switzerland). Gesundheitswesen. 2011;73(1):46-53.

54. Vrazi V, Kikinis J, Lucijanac T, et al. The prevalence of overweight and obesity among Croatian hospitalized coronary heart disease patients. Coll Antropol. 2012;36(Suppl 1):211-216.

55. Vrazic H, Kikinis J, Lucijanac T, et al. The prevalence of overweight and obesity among Croatian hospitalized coronary heart disease patients. Coll Antropol. 2012;36(Suppl 1):211-216.

56. World Health Organization and UNICEF United Nations Children’s Fund. Recommendations for Data Collection, Analysis and Reporting on Anthropometric Indicators in Children Under 5 Years Old. [See Table 10, page 82.] Geneva: WHO; 2019.

57. World Health Organization and UNICEF United Nations Children’s Fund. Recommendations for Data Collection, Analysis and Reporting on Anthropometric Indicators in Children Under 5 Years Old. [See Table 10, page 82.] Geneva: WHO; 2019.

58. World Health Organization. Obesity: Missing the 2025 Global Targets. London: World Obesity Federation; 2020.

59. World Health Organization. Obesity: Missing the 2025 Global Targets. London: World Obesity Federation; 2020.

60. World Health Organization. Obesity: Missing the 2025 Global Targets. London: World Obesity Federation; 2020.

61. World Health Organization. Obesity: Missing the 2025 Global Targets. London: World Obesity Federation; 2020.

62. World Health Organization. Obesity: Missing the 2025 Global Targets. London: World Obesity Federation; 2020.

63. World Health Organization. Obesity: Missing the 2025 Global Targets. London: World Obesity Federation; 2020.

64. World Health Organization. Obesity: Missing the 2025 Global Targets. London: World Obesity Federation; 2020.

65. WHO. Breast cancer outcomes in a population with high prevalence of obesity and diabetes mellitus in Konya, a central Anatolian city in Turkey. Diabetes Res Clin Pract. 2005;70(2):151-158.

66. WHO. Breast cancer outcomes in a population with high prevalence of obesity and diabetes mellitus in Konya, a central Anatolian city in Turkey. Diabetes Res Clin Pract. 2005;70(2):151-158.

67. WHO. Breast cancer outcomes in a population with high prevalence of obesity and diabetes mellitus in Konya, a central Anatolian city in Turkey. Diabetes Res Clin Pract. 2005;70(2):151-158.
68. de Onis M, Blössner M, Borghi E. Global prevalence and trends of overweight and obesity among preschool children. *Am J Clin Nutr*. 2010;92(5):1257-1264.

69. Giorgi E, Osman AA, Hassan AH, et al. Using non-exceedance probabilities of policy-relevant malaria prevalence thresholds to identify areas of low transmission in Somalia. *Malar J*. 2018;17(1):88. https://doi.org/10.1186/s12936-018-2238-0

70. National Institute for Health Care and Clinical Excellence (NICE). *Quality Statement 2: General Practice in Areas of High and Extremely High HIV Prevalence*. London: NICE; 2017.

**SUPPORTING INFORMATION**

Additional supporting information may be found in the online version of the article at the publisher’s website.

**How to cite this article:** Lobstein T, Jewell J. What is a “high” prevalence of obesity? Two rapid reviews and a proposed set of thresholds for classifying prevalence levels. *Obesity Reviews*. 2022;23(2):e13363. doi:10.1111/obr.13363