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## Trends in underweight and obesity — scale of the problem

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A recent study reports that the global prevalence of paediatric obesity increased to >5% between 1975 and 2016. This increase occurred even as the prevalence of paediatric underweight decreased slightly but remained >8%. These average prevalence changes blur the remarkable regional variations in how prevalence has changed. There is a pressing need to address both underweight and obesity worldwide.

*Refers to NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. Lancet [http://dx.doi.org/10.1016/S0140-6736\(17\)32129-3](http://dx.doi.org/10.1016/S0140-6736(17)32129-3) (2017)*

overweight prevalence changed from 1975 to 2016 (REF. 1). The authors carefully vetted the data — only data sets for which actual (measured) heights and weight were collected using a probabilistic sampling method during a defined sampling time frame were included. The investigators also excluded participants with implausible BMIs and those recruited based on biased selection strategies (for example, people who had been included or excluded based on their health status or cardiovascular risk).

The total sample size in the present study was 128.9 million participants, among whom were 31.5 million children and adolescents. The investigators organized the data mostly according to geographical and national income regions, with the exception of a geographically dispersed group of high-income English-speaking countries (Australia, Canada, Ireland, New Zealand, UK and USA) that seemed sufficiently similar in their trends to be combined. The group analysed the data using a model that allowed for regional differences in BMI within countries and modelled time trends for BMI with nonlinear terms that would enable the dissection of changes in the pace with which BMI had changed.

The results confirmed and extended prior global studies, finding evidence for increases in obesity prevalence and small decreases in underweight prevalence. Overall, the prevalence of paediatric obesity increased more than fivefold to >5% for both boys and girls aged 5–19 years. In addition, the worldwide prevalence of paediatric underweight decreased in girls from 9.2% to 8.4% and in boys from 14.8% to 12.4%. The study also documented remarkable regional disparities in how BMI has changed in the past 40 years. In Eastern Europe, there seemed to have been little increase in the prevalence of paediatric obesity since 1975. By contrast, in northwestern Europe, high-income English-speaking countries and a few other places, the rate of increase in BMI was high before 2000, but has slowed more recently. In Micronesia and Polynesia the prevalence of paediatric obesity has risen dramatically throughout the past 40 years, such that >30% of boys and girls in the Cook Islands, Nauru and Palau were obese last year. At the same time, underweight still affected more than 20% of girls and 30% of boys living in India.

A recent paper documents that worldwide the prevalence of underweight remains high, even though the prevalence of obesity is increasing in many regions of the world<sup>1</sup>. Childhood undernutrition is associated with sarcopenia, cardiac and renal dysfunction, and immunological defects and might cause as many as 3.1 million deaths annually (45% of all deaths of children worldwide)<sup>2</sup>. Obesity during childhood increases the risk of abnormalities in cardiovascular function, glucose homeostasis, pulmonary function and cognition during childhood<sup>3</sup>, as well as the risk of obesity (and therefore mortality) in adulthood<sup>4</sup>.

The prevalence of obesity in the USA increased dramatically from the 1970s to the early 2000s<sup>5</sup>. A slower rate of increase has

occurred since then, such that in 2015–2016, the prevalence of obesity in the USA was an alarming 13.9% among preschool-aged children (2–5 years of age), 18.4% in school-aged children (6–11 years of age), 20.6% among adolescents (12–19 years of age), and an even more alarming 39.8% in adults<sup>6</sup>. From 1975 to 2014, the prevalence of underweight (BMI <5th percentile standard) in US children 2–19 years of age decreased from ~5.1% to ~3.8%<sup>7</sup>; the prevalence of underweight among US adults also decreased, from 3.6% to 1.4%<sup>8</sup>.

Worldwide data from 2,416 population-based studies have now been pooled and analysed by investigators in the NCD Risk Factor Collaboration to produce the most complete global perspective of how underweight and

The study showed that, worldwide, 124 million children had obesity and 192 million children were moderately or severely underweight in 2016. We must therefore confront a bidirectional crisis: how do we ameliorate underweight while preventing obesity at the same time? The proposed solutions, which address how best to manage both energy intake and energy expenditure, suggest action not only by individual families but also by governments and the food and beverage industries. The evident disparities in regional prevalence offer opportunities to test approaches and identify the most promising strategies<sup>9</sup>.

The goal of providing a nutritious and healthy diet that keeps most children at a healthy BMI has so far proved elusive. As we have reduced societal undernutrition, obesity has become more prevalent — this result is unfortunately not surprising. During the evolutionary past, proto-humans and their predecessors were probably chronically undernourished. Humans did not learn to preserve most foods until recent times, so the discovery of a food source necessitated immediate consumption. Those who could ‘feast’ to a greater degree might have had a reproductive advantage, leading to the overrepresentation of genetic variants that promoted more rapid eating, tolerance of abdominal distention and the efficient storage of excess energy in adipose tissue.

Evidence strongly supports the theory that a substantial portion of the variance in a child’s body weight, perhaps ~80%<sup>10</sup>, can be attributed to inherited factors that are genetic

or epigenetic. Considerable data also indicate the existence of multiple, redundant mechanisms to help ensure a rapid physiological response to conserve energy when weight is too low. These systems are still essential for the survival of the many people who live in regions where undernutrition is common. As regions become more developed, however, the ready availability of inexpensive, energy-dense foods and the reduction in obligate energy expenditure for survival that make severe undernutrition rare, offer a perfect opportunity for genetic predispositions for obesity to manifest themselves. The past 40 years have thus provided an unparalleled opportunity to observe the interaction of genetic factors with the environment. Our as-yet unmet societal challenge remains how to alleviate the immediate and devastating consequences of undernutrition while avoiding our predisposition for overnutrition.

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#### Competing interests statement

The author declares no competing interests.