

Analysing Obesity Epidemicity and Endemicity: Introducing New Quantitative Indices

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Abstract

As obesity becomes more and more common, it will get (or may already have) converted from an epidemic to an endemic. This opinion piece discusses these epidemiological definitions in the context of obesity and proposes three obesity epidemicity indices to quantify their indices. It discusses the rationale behind using such ratios to measure endemicity. The discussion notes how the different ratios give markedly divergent results and call for greater attention to this aspect of obesity epidemiology.

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Introduction

The term 'endemic' and its opposite, 'epidemic,' were both coined by Hippocrates. The Dictionary of Epidemiology defines an endemic disease as "the constant presence of a disease or infectious agent within a given geographic area or population group; it may also refer to the usual prevalence of a given disease within such an area or group." Epidemic, conversely, is "the occurrence in a community or region of cases or an illness, specific health-related behaviour, or other health-related events clearly in excess of normal expectancy."¹

Though used earlier in the context of infectious disease, the word epidemic is also frequently used nowadays as a noun or adjective while discussing non-communicable diseases (NCDs).² Earlier discussants described the concept of diabetes endemicity instead of epidemicity.² The phenomenon of endemicity has also been applied to other NCDs like goitre or iodine deficiency disorders.³

As obesity is now classified as a disease, criteria are also needed to define its endemicity.⁴ It is well known that

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generalised obesity and localised fat deposition have been endemic to certain countries and communities. Examples include the obese phenotype noted in Pacific Islanders, as well as steatopygia found in tribal women in Africa.⁵

Obesity seems to meet the requirements of both these definitions. While we continue to speak of obesity as an epidemic, rapidly changing secular trends may necessitate a change in our approach. In this opinion piece, we propose and critique indices that can be used to quantify the endemicity, or epidemicity, of obesity. We purposefully focus on endemicity, as we feel this will be used more frequently in the future. The indices are based on the natural history of obesity: childhood obesity continuing to adult obesity, and simultaneously, overweight status leading to obesity. Even though multiple biological, psychological, and socioenvironmental factors affect this progression, these phenomena can help us predict the expected endemicity of obesity through the indices listed below.

Suggested Endemicity Indices

Obesity: Overweight prevalence ratio

The Obesity Endemicity Index (OEnI) can be defined in a way similar to that of the diabetes endemicity index.²

$$\text{Proposed OEnI} = \frac{\text{Prevalence of obesity}}{\text{Prevalence of overweight}}$$

A value >1 suggests that obesity has become endemic to a particular region, community, or group of people. A value <1 implies that the obesity epidemic will continue to worsen in this cohort.

Adult: childhood obesity prevalence ratio

Yet another way of calculating OEnI can be to compare childhood obesity prevalence rates with those of adult obesity

$$\text{Proposed OEnI} = \frac{\text{Prevalence of adult obesity}}{\text{Prevalence of childhood obesity}}$$

Again, an OEnI >1 conveys a state of endemicity, while a ratio <1 means that the obesity epidemic is still evolving.

Temporal trends ratio

The indices defined above are based on current estimates of prevalence. Temporal trends may be used to define

obesity endemicity as well. Variations in prevalence data can be analyzed over the past few decades, along with expected trends over the coming year. An increase <2 standard deviation (SD) over a decade, maintained for at least 2 decadal intervals, portrays a picture of 'stability' in incidence and of endemicity of obesity. On the other hand, a >2 SD decadal increase in obesity prevalence deserves to be described as an ongoing epidemic.

$$\text{Proposed OEnI} = \frac{\text{Prevalence of obesity in the current decade}}{\text{Prevalence of obesity in the previous decade}}$$

$$\text{Proposed OEpl} = \frac{\text{Prevalence of obesity in the upcoming decade}}{\text{Prevalence of obesity in the current decade}}$$

Epidemicity Indices

Conversely, epidemicity indices can also be calculated for obesity. These can be termed the Obesity Epidemicity Index (OEpl)

$$\text{Proposed OEpl} = \frac{\text{Prevalence of overweight}}{\text{Prevalence of obesity}}$$

$$\text{Proposed OEpl} = \frac{\text{Prevalence of childhood obesity}}{\text{Prevalence of adult obesity}}$$

$$\text{Proposed OEpl} = \frac{\text{Obesity \% in upcoming decade}}{\text{Obesity \% in the current decade}}$$

$$\text{Proposed OEpl} = \frac{\text{Obesity \% current decade}}{\text{Obesity \% previous decade}}$$

These ratios are the opposite of the previously described OEnI.

Application to Global Statistics

Data from the World Obesity Atlas, 2024, reveals interesting observations.⁷ Based upon a relative prevalence of overweight and obesity, obesity seems endemic to the Eastern Mediterranean Region (EMRO) (125.25 million persons overweight, 133.68 persons with obesity) and the Pan American Region (PAHO) (245.4 million overweight, 292.55 million obese). This ratio does not seem to correlate with the overall prevalence of overweight/obesity, which is 54% for EMRO and 71% for PAHO. Europe seems to have a fairly stable growth curve (255.11 million overweight, 212.73 million obese), even though its overall prevalence rate is 66%. Two regions with a 'relatively' low prevalence of overweight/obesity, the South East Asian Region (SEARO) and the Western Pacific Region (WPRO) have the lowest OEnI or highest OEpl indices (Table 1). A similar analysis, based on country income, highlights that while obesity seems endemic, or nearly endemic, in low-income and high-income countries, upper-middle-income countries should be prepared for an obesity epidemic (Table 2).

Comparing childhood and adult obesity rates reveals a

Table-1: Adult Obesity: Prevalence across WHO regions in 2025.

	Overweight (million)	Obesity (million)	OEnI	OEpl
AFRO	143.51	94.74	0.66	1.52
EMRO	125.25	133.68	1.06	0.94
EU	255.11	212.73	0.83	1.20
PAHO	245.40	292.55	1.19	0.84
SEARO	305.86	110.28	0.36	2.77
WPRO	449.30	160.25	0.36	2.80

Table-2: Prevalence rates of obesity according to country income in 2025.

	Overweight (million)	Obesity (million)	OEnI	OEpl
Low income	57.76	41.23	0.71	1.40
Low-middle income	479.29	254.82	0.53	1.88
High middle income	669.30	392.20	0.58	1.71
High income	316.07	312.85	0.99	1.01

Table-3: Childhood and adult overweight/obesity: prevalence rates across WHO regions in 2025.

	Adults %	Childhood %	OEnI	OEpl
AFRO	39	19	2.05	0.49
EMRO	54	28	1.93	0.52
EU	66	29	2.28	0.44
PAHO	71	43	1.65	0.60
SEARO	30	17	1.76	0.57
WPRO	41	42	0.98	1.02

different analysis. Childhood obesity prevalence is low compared to adult obesity in most WHO regions (Table 3). The WPRO is the only region with an almost equal prevalence of childhood and adult obesity (42% and 41%), respectively. Does this mean that obesity is endemic to Western Pacific, or does it mean that the obesity epidemic is yet to come? An overview of prevalence data from 2020 onwards suggests that the obesity epidemic may plateau or behave like an endemic from the year 2030 or 2035 onwards. However, childhood obesity is poised to retain its epidemic character over the coming decades.

Critical Analysis

While these indices may not be perfect, they bring objectivity to a highly dynamic field. Studying the endemicity and epidemicity indices for obesity is essential for comprehending its prevalence and distribution across populations over time. We propose greater discussion and debate regarding the endemicity or potential endemicity of obesity. While epidemicity indices highlight sudden increases or outbreaks in obesity rates, indicating emerging public health crises that demand immediate attention and action, endemicity facilitates a balanced, long-term approach to health management.

Judicious use of the insight gained from these calculations will assist policymakers and planners in allocating resources and funds. Endemicity provides valuable insights into the stable baseline levels of obesity within specific

regions, reflecting long-term public health influences, socioeconomic factors, and environmental conditions. This understanding helps identify regions where obesity is persistently high and requires sustained intervention. It will also help clinicians plan suitable individual-based and community-based interventions against obesity. The data can be used for public awareness and advocacy and for social marketing for measures designed to achieve a healthy weight. They can also be used in health economic modelling to assess the utility of various anti-obesity medications such as glucagon-like peptide 1 receptor agonists (GLP1RA) and dual peptide agonists (tirzepatide).^{8,9}

By analysing these indices, researchers can identify temporal and spatial patterns, assess the impact and effectiveness of public health interventions, and efficiently allocate resources. Additionally, understanding these dynamics aids in predicting future trends, enabling the formulation of proactive policies and strategies aimed at mitigating obesity-related health risks, improving population health outcomes, and addressing disparities in obesity prevalence across different communities.

References

1. Porta M, Ed. Dictionary of Epidemiology 2008. 5th ed New York: Oxford University Press;pp 78–9.
2. Kalra S, Kumar A, Jarhyan P, Unnikrishnan AG. Endemic or epidemic? Measuring the endemicity index of diabetes. *Indian J Endocrinol Metabol.* 2015;19:5-7.
3. Koutras DA. Endemic goiter: An update *Hormones (Athens)*. 2002; 1:157–64.
4. McIntyre HD, Gibbons KS, Flenady VJ, Callaway LK. Overweight and obesity in Australian mothers: epidemic or endemic? *Med J Aust.* 2012 ;196:184-8.
5. De Villiers H. The tablier and steatopygia in Kalahari Bushwomen. *S Afr J Sci.* 1961;57:223-7.
6. Hardin J, McLennan AK, Brewis A. Body size, body norms and some unintended consequences of obesity intervention in the Pacific islands. *Ann Hum Biol.* 2018;45:285-94.
7. World Obesity Atlas 2024. Available at: <https://data.worldobesity.org/publications/WOF-Obesity-Atlas-v7.pdf> Last accessed on 16 July 2024.
8. Chao AM, Tronieri JS, Amaro A, Wadden TA. Semaglutide for the treatment of obesity. *Trends Cardiovasc Med.* 2023;33:159-66.
9. Tan B, Pan XH, Chew HS, Goh RS, Lin C, Anand VV, et al. Efficacy and safety of tirzepatide for treatment of overweight or obesity. A systematic review and meta-analysis. *International Journal of Obesity(IJO).* 2023;47:677-85.