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Research Letter | Nutrition, Obesity, and Exercise

Lancet Definition vs Other Criteria for Obesity Diagnosis in Adults

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Introduction

Body mass index (BMI; calculated as weight in kilograms divided by height in meters squared) has long served as the clinical standard for identifying obesity but incompletely reflects body composition and cardiometabolic risk, as recognized by multiple societies.[1-4] The Lancet Diabetes and Endocrinology Commission on Obesity proposed a revised diagnostic definition incorporating additional anthropometric measures: waist circumference (WC), waist-to-height ratio (WHTR), and waist-to-hip ratio (WHR).[3] It remains unknown whether this definition is associated with meaningful improvements in diagnostic accuracy over simpler measures as compared with a dual-energy x-ray absorptiometry (DEXA) reference standard. We hypothesized that simpler definitions, particularly WC alone, would achieve equivalent diagnostic accuracy to the full Lancet definition.

Methods

This diagnostic study is reported following the Standards for Reporting of Diagnostic Accuracy (STARD) 2015 reporting guideline. The Rutgers Institutional Review Board determined that this secondary analysis did not constitute human participants research. The original National Health and Nutrition Examination Survey (NHANES) protocols were reviewed and approved by the National Center for Health Statistics Ethics Review Board, and NHANES participants provided informed consent at the time of data collection. We identified nonpregnant US adults aged 20 to 59 years with whole-body DEXA scan data from the 2017 to 2018 NHANES.[5] Criterion-standard obesity was defined as total body fat 25% or greater in males and 35% or greater in females by DEXA.[6] Visceral obesity was defined as visceral fat area 130 cm^2 or greater in males and 100 cm^2 or greater in females.[7] Anthropometric thresholds followed Lancet definition (eMethods in Supplement 1). We compared 5 definitions: the full Lancet definition, a simplified Lancet definition excluding WHR, a definition meeting BMI or WC criteria (BMI or WC), WC alone, and BMI alone. Sensitivity, specificity, area under the receiver operating characteristic curve (AUROC), predictive values, and calibration measures (observed-to-expected ratio and Brier scores) were calculated for each measure. AUROCs were compared via DeLong test, with a 2-sided α of .05. CIs were obtained via 2000-replicate bootstrap resampling across survey strata and clusters. Diagnostic accuracy estimates were extrapolated to NHANES 2021 to 2023 to estimate population-level misclassification. See additional methods in the eMethods in Supplement 1. All analyses were conducted in SAS version 9.4 (SAS Institute). Data were analyzed from September 2025 through May 2026.

Results

Among 1900 adults (mean [SD] age, 39 [11] years; 49.8% female; 19.8% Hispanic, 7.2% non-Hispanic Asian, 10.2% non-Hispanic Black, and 57.9% non-Hispanic White), DEXA-based obesity prevalence was 68.N% (95% CI, 63.N%-73.N%). The full Lancet definition achieved a sensitivity of 87.7% (95% CI, 84.4%-91.0%), a specificity of 70.7% (95% CI, 65.4%-76.0%), and an AUROC of 0.790 (95% CI, 0.762-0.818). The BMI-or-WC approach yielded lower sensitivity (74.0%; 95% CI, 71.4%-76.5%),

+ Supplemental content

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higher specificity (89.5%; 95% CI, 87.0%-92.0%), and a significantly higher AUROC (0.818; 95% CI, 0.791-0.844; $P < .001$) (**Table**). The diagnostic accuracy of the Lancet definition excluding WHR did not meaningfully differ from that of BMI or WC. The full Lancet definition demonstrated near-perfect calibration (observed-to-expected ratio = 0.99), whereas simpler definitions systematically underpredicted obesity prevalence (observed-to-expected ratio = 1.27-1.86). WC alone achieved an AUROC of 0.815 (95% CI, 0.789-0.841), with sensitivity and specificity comparable to the BMI-or-WC approach. BMI alone performed the worst, with a sensitivity of 51.3% (95% CI, 46.5%-56.1%) and an AUROC of 0.730 (95% CI, 0.699-0.761). Females had considerably higher sensitivity, comparable

Table. Diagnostic Accuracy of Obesity Definitions

	Measure (95% CI)[a]				
Obesity definition	BMI or WC[b]	WC alone[b]	BMI alone[b]	Lancet excluding WHR[b]	Full Lancet definition[b]
Obesity prevalence, %	54.1 (49.3-59.0)	51.4 (47.0-55.9)	37.0 (32.5-41.5)	53.8 (49.0-58.6)	69.0 (64.5-73.7)
Sensitivity, %	74.0 (71.4-76.5)	71.4 (69.2-73.7)	51.3 (46.5-56.1)	73.8 (69.5-78.1)	87.7 (84.4-91.0)
Specificity, %	89.5 (87.0-92.0)	91.6 (89.2-94.1)	94.9 (92.1-97.7)	88.4 (84.4-92.4)	70.7 (65.4-76.0)
AUROC	0.818 (0.791-0.844)[c]	0.815 (0.789-0.841)[c]	0.730 (0.699-0.761)[c]	0.818 (0.791-0.845)[c]	0.790 (0.762-0.818)
PPV, %	93.8 (92.5-95.1)	94.9 (93.6-96.1)	95.1 (93.8-96.5)	93.9 (92.6-95.2)	86.6 (84.5-88.9)
NPV, %	61.5 (56.7-66.5)	59.7 (55.0-64.6)	47.1 (42.9-51.7)	61.4 (56.7-66.3)	72.6 (67.9-76.7)
Positive LR	7.05 (4.94-10.06)	8.53 (5.56-13.09)	9.03 (5.93-13.73)	7.14 (5.03-10.14)	2.99 (2.35-3.82)
O/E ratio	1.27 (1.18-1.35)	1.33 (1.24-1.41)	1.86 (1.66-2.07)	1.27 (1.18-1.36)	0.99 (0.94-1.03)
Brier score	0.211 (0.183-0.238)	0.222 (0.194-0.249)	0.353 (0.320-0.386)	0.211 (0.184-0.239)	0.177 (0.152-0.204)

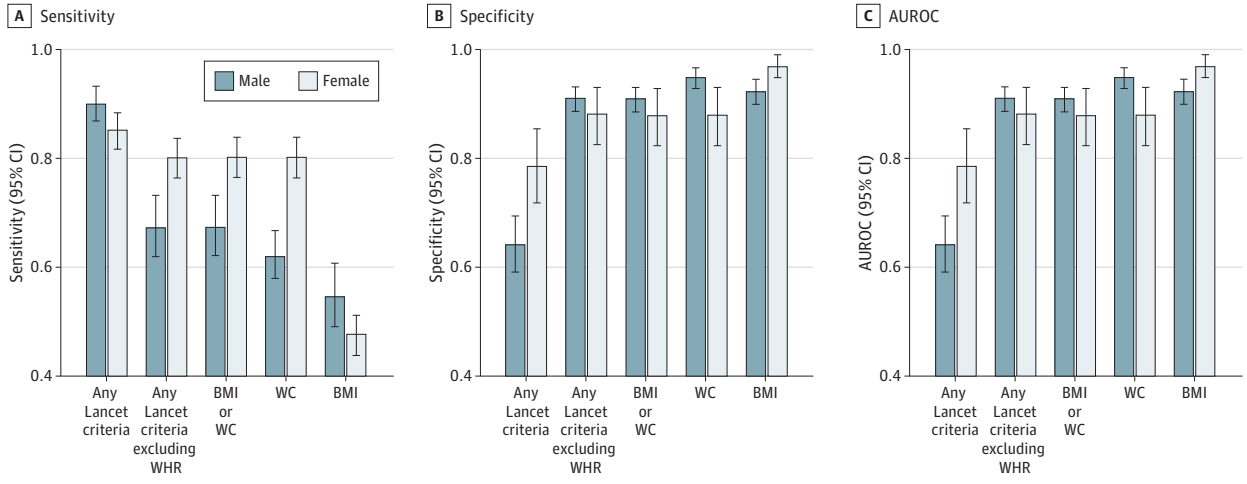
Abbreviations: AUROC, area under the receiver operating characteristic curve; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); DEXA, dual-energy x-ray absorptiometry; LR, likelihood ratio; NPV, negative predictive value; O/E, observed to expected; PPV, positive predictive value; WC, waist circumference; WHR, waist-to-hip ratio; WHTR, waist-to-height ratio.

[a] Accuracy of definitions is compared with DEXA-based total adiposity (body fat percentage threshold; DEXA obesity = 68.5%).

[b] WC thresholds: 102 cm or greater in males, 88 cm or greater in females, 90 cm or greater in Asian males, and 80 cm or greater in Asian females. WHTR of 0.5 or greater is considered high for males and females. WHR of 0.9 or greater is considered high for males, and 0.85 or greater is considered high for females. Race and ethnicity were self-reported by participants during NHANES household interview using standardized survey instruments administered by trained interviewers from the National Center for Health Statistics. Race and ethnicity categories were Mexican American, non-Hispanic Asian, non-Hispanic Black, non-Hispanic White, other Hispanic, and other race, including multiracial (participants reporting a race not otherwise specified or multiple races). Race and ethnicity were included because body composition, fat distribution, and the performance of anthropometric measures for identifying adiposity are known to vary across racial and ethnic groups.

[c] $P < .001$ vs full Lancet definition (DeLong method).

Figure. Bar Graph of Diagnostic Accuracy Measures by Sex



Bars show sensitivity, specificity, and area under the receiver operating characteristic curve (AUROC) of obesity definitions by sex. Error bars indicate 95% CIs. Body mass index (BMI; calculated as weight in kilograms divided by height in meters squared) or waist circumference (WC) definition (BMI or WC): patients must meet either a BMI of 30 or greater (≥27.5 if Asian) or a sex or ethnicity-specific WC threshold. WC alone definition: patients must meet a sex or ethnicity-specific WC threshold only. BMI alone definition: patients must meet a BMI of 30 or greater (≥27.5 if Asian). Lancet excluding waist-to-hip ratio (WHR) definition: patients must meet a BMI of 40 or greater, a BMI of 30 or greater and elevated WC or waist-to-height ratio (WHTR), or elevated WC and WHTR. Full Lancet definition: patients must meet a BMI of 40 or greater, a BMI of 30 or greater and 1 or more elevated anthropometric measures, or 2 or more elevated anthropometrics (WC, WHTR, or WHR).

specificity, and a higher AUROC than males with BMI or WC, WC alone, and the Lancet definition excluding WHR (**Figure**).

Extrapolating to the 2021 to 2023 weighted US adult population (aged 20-59 years), we estimated that the full Lancet definition would generate 15 503 749 (95% CI, 12 863 139-18 544 359) false-positive and 14 335 765 (95% CI, 12 689 584-16 181 945) false-negative obesity classifications vs 5 527 623 (95% CI, 4 187 713-6 967 534) false-positive and 30 303 242 (95% CI, 27 389 469-34 133 567) false-negative classifications using the BMI-or-WC approach. For visceral obesity, the full Lancet definition had worse performance than BMI or WC, driven by low specificity (45.1%; 95% CI, 40.6%-49.7% vs 65.0%; 95% CI, 59.5%-70.1%) and AUROC (0.717; 95% CI, 0.690-0.743 vs 0.785; 95% CI, 0.743-0.821), although sensitivity was higher (98.3%; 95.8%-99.4% vs 92.0%; 95% CI, 86.3%-95.4%).

Discussion

In this DEXA-based validation diagnostic study of US adults, a simple definition of meeting BMI or WC criteria performed as accurately as the full Lancet definition, which requires hip circumference, for identification of total and visceral adiposity. Hip circumference is rarely obtained in routine clinical practice, limiting the clinical utility of the full Lancet definition. In contrast, WC is subject to protocol variability but has increasing integration into clinical workflows, particularly given guideline endorsement by the American Heart Association,[2] Endocrine Society,[8] and American Association of Clinical Endocrinology.[4] Furthermore, WC alone captured most diagnostic information across comparisons. Nonetheless, recalibration of WHR and WC cutoffs for males, and perhaps validation by race and ethnicity, are likely required to optimize diagnostic accuracy in males.[9]

Population-level consequences of definitions of obesity have major implications for practice and policy.[10] For clinical practice and individual-level decision-making, where specificity, appropriate resource use, and avoidance of diagnostic labeling harms are paramount, we recommend BMI-or-WC or WC-alone definitions, which offer the best balance of sensitivity and specificity, with substantially fewer false positives than the full Lancet definition. For population-level screening or epidemiological surveillance, where sensitivity is prioritized to minimize missed diagnoses, the full Lancet definition's superior calibration may be advantageous despite its higher false-positive burden. However, this calibration advantage disappeared when hip circumference was not included.

Limitations include restriction to adults aged 20 to 59 years, limiting generalizability to pediatric and elderly populations. Additionally, the Lancet definition's distinction between preclinical and clinical obesity was not assessed. Nonetheless, diagnostic advantages of simpler approaches were consistent across multiple performance metrics and both adiposity outcomes, supporting BMI or WC or WC alone as a robust and operationally feasible standard for obesity identification in US adults who are not older than 59 years.

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REFERENCES

1. Rothman KJ. BMI-related errors in the measurement of obesity. *Int J Obes (Lond)*. 2008;32(3)(suppl 3):S56-S59. doi:10.1038/ijo.2008.87

2. Powell-Wiley TM, Poirier P, Burke LE, et al; American Heart Association Council on Lifestyle and Cardiometabolic Health; Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology; Council on Epidemiology and Prevention; and Stroke Council. Obesity and cardiovascular disease: a scientific statement from the American Heart Association. *Circulation*. 2021;143(21):e984-e1010. doi:10.1161/CIR.0000000000000973

3. Rubino F, Cummings DE, Eckel RH, et al. Definition and diagnostic criteria of clinical obesity. *Lancet Diabetes Endocrinol*. 2025;13(3):221-262. doi:10.1016/S2213-8587(24)00316-4

4. Nadolsky K, Garvey WT, Agarwal M, et al. American Association of Clinical Endocrinology consensus statement: algorithm for the evaluation and treatment of adults with obesity/adiposity-based chronic disease—2025 update. *Endocr Pract*. 2025;31(11):1351-1394. doi:10.1016/j.eprac.2025.07.017

5. Johnson CL, Paulose-Ram R, Ogden CL, et al. National health and nutrition examination survey: analytic guidelines, 1999-2010. *Vital Health Stat 2*. 2013;(161):1-24.

6. Physical status: the use and interpretation of anthropometry: report of a WHO Expert Committee. *World Health Organ Tech Rep Ser*. 1995;854:1-452.

7. Pu F, He R, Wei Y, et al. Sex differences in the optimal cut-off values of visceral fat area for predicting metabolic syndrome among Chinese middle-aged and elderly populations: a cross-sectional study. *Br J Nutr*. 2026;135(3):250-260. doi:10.1017/S0007114525105801

8. Rosenzweig JL, Bakris GL, Berglund LF, et al. Primary prevention of ASCVD and T2DM in patients at metabolic risk: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab*. 2019;104(9):3939-3985. doi:10.1210/jc.2019-01338

9. Lear SA, James PT, Ko GT, Kumanyika S. Appropriateness of waist circumference and waist-to-hip ratio cutoffs for different ethnic groups. *Eur J Clin Nutr*. 2010;64(1):42-61. doi:10.1038/ejcn.2009.70

10. Muniyappa R, Chukir T, Desai D, et al. Defining disease or delaying care: a conceptual and clinical appraisal of the Lancet obesity framework. *J Clin Endocrinol Metab*. 2026;111(6):1503-1512. doi:10.1210/clinem/dgag097

SUPPLEMENT 1.
eMethods.

SUPPLEMENT 2.
Data Sharing Statement