“Lean MASLD” Typically Clustered Near Obese BMI Threshold

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Last updated 19 February 2026 • Check for updates at EpicResearch.org

Key Findings:

- Among adults aged 45 to 64 who were diagnosed with metabolic dysfunction-associated steatotic liver disease (MASLD), those with a non-obese BMI (below 30) were skewed just below the obese BMI threshold with more than 80% having an overweight BMI (25.0–29.9).
- Across BMI categories, endocrine and circulatory conditions were common at all BMI classifications and increased with higher BMI, reflecting a progressively broader cardiometabolic burden among patients with obesity and severe obesity.
- Underweight adults stood out with the highest rates of blood disorders, indicating a clinically distinct subgroup compared with higher-BMI MASLD patients.

Metabolic dysfunction-associated steatotic liver disease (MASLD), previously known as non-alcoholic fatty liver disease, is the most common chronic liver disease worldwide, affecting an estimated one in four U.S. adults.[1] Although MASLD is closely associated with obesity, the disease also occurs in individuals without obesity, a phenomenon known as "lean MASLD”.[2]

To better understand factors that influence MASLD, particularly those at non-obese BMIs, we studied 190,335 patients diagnosed with MASLD between ages 45 and 64 who did not have hepatitis, alcohol-related disorders, amputations, or tamoxifen exposure. Patients were categorized into six BMI groups based on their BMI measurement in the year prior to their diagnosis: underweight (<18.5), healthy weight (18.5–24.9), overweight-low (25.0–27.4), overweight-high (27.5–29.9), class 1—2 obesity (30.0–39.9), and class 3 obesity (40+).

We found that most patients diagnosed with MASLD (79.1%) had an obese BMI. Among non-obese patients, MASLD was most common in the overweight range and least common in underweight and healthy weight categories. This pattern suggests that excess weight is a risk factor for MASLD even among patients who are not clinically obese.

BMI Distribution Among Patients with MASLD

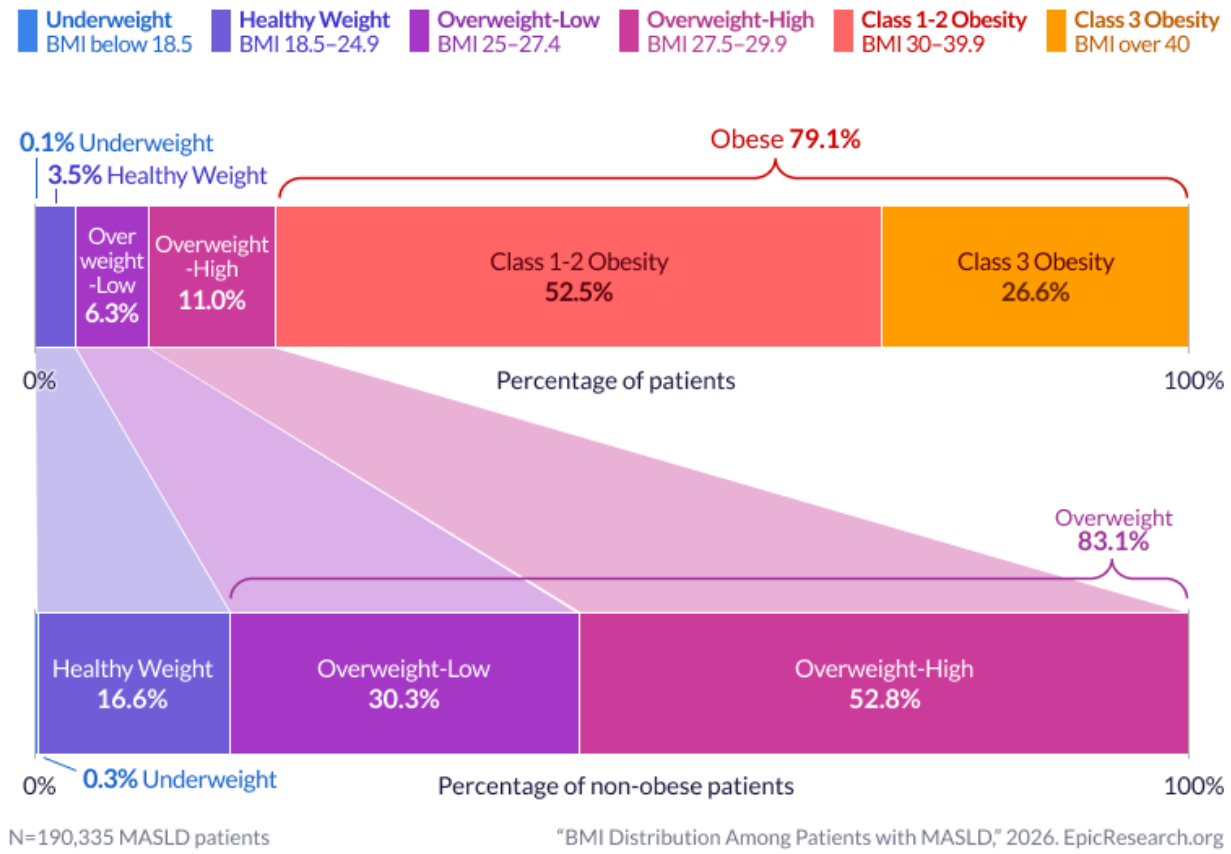

Figure 1. The BMI distribution among non-obese patients aged 45–64 with MASLD

While BMI is a primary risk factor in the development of MASLD, we examined whether additional conditions were correlated with MASLD. Circulatory disorders increased substantially from underweight to severe obesity (47.5% to 81.9%), and endocrine disorders were highly prevalent across all BMI groups and increased further with an increase in BMI (79.2% to 95.6%), consistent with a growing cardiometabolic burden as BMI rises among patients with MASLD.

In contrast, underweight patients exhibited a distinct profile, including the highest rates of blood disorders (41.7%), which suggests this subgroup might differ meaningfully from higher-BMI MASLD patients and might warrant closer attention to other factors.

Comorbidity Rates Among Patients with MASLD by BMI Class

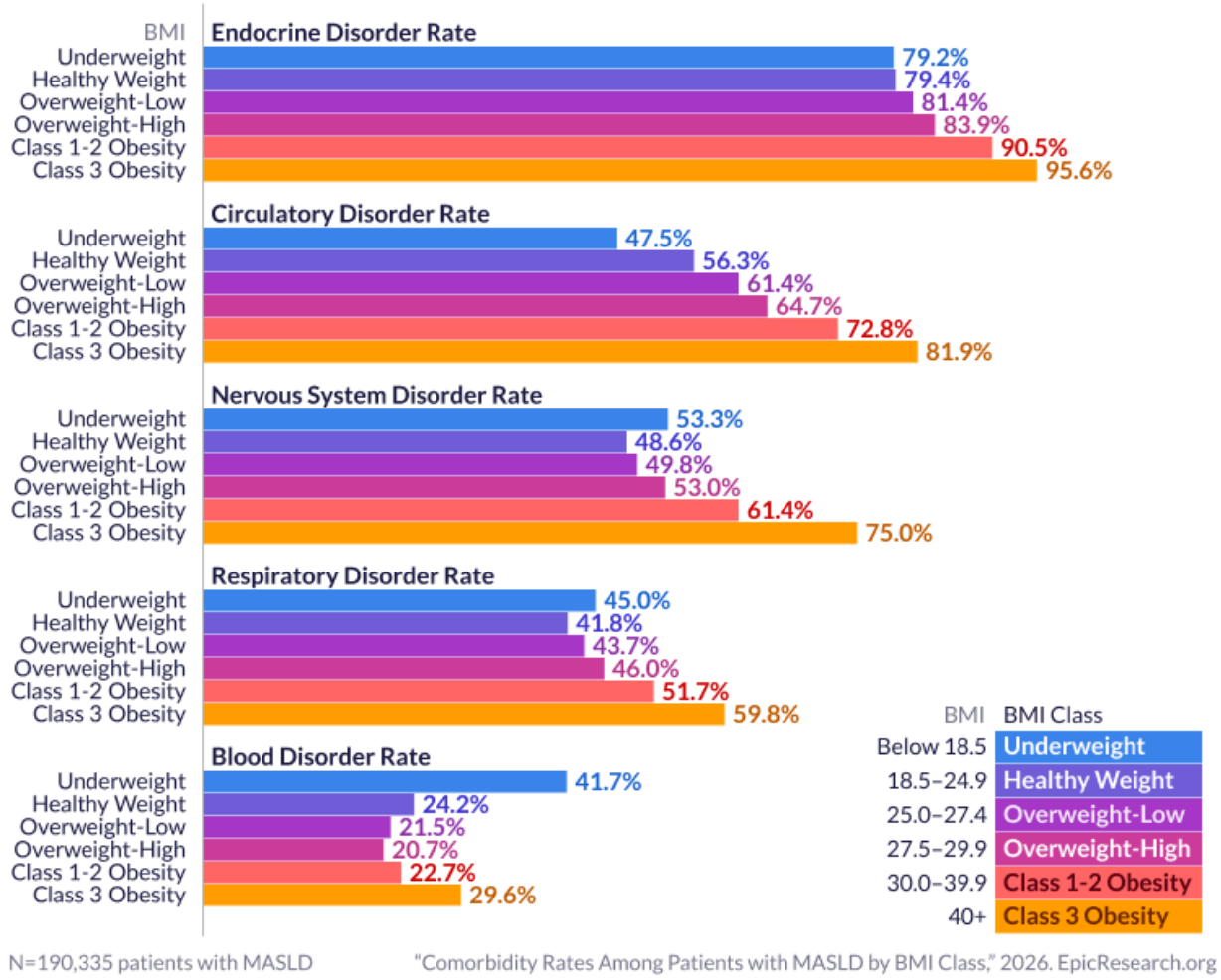

Figure 2. The prevalence of condition groups among patients aged 45–64 with MASLD by their BMI classification.

These data come from Cosmos, a dataset created in collaboration with a community of Epic health systems representing more than 300 million patient records from 1,800 hospitals and more than 42,000 clinics from all 50 U.S. states, Canada, Lebanon, and Saudi Arabia. This study was completed by two teams that worked independently, each composed of a clinician and research scientists. The two teams came to similar conclusions. Graphics by Brian Olson.

References

1. Sheth SG, Chopra S. Clinical features and diagnosis of metabolic dysfunction-associated steatotic liver disease (nonalcoholic fatty liver disease) in adults. UpToDate. March 7, 2025. https://www.uptodate.com/contents/clinical-features-and-diagnosis-of-metabolic-dysfunction-associated-steatotic-liver-disease-nonalcoholic-fatty-liver-disease-in-adults. Accessed August 27, 2025.
2. Rotaru A, Stratina E, Huiban L, et al. Beyond BMI: revealing metabolic risk in lean MASLD. Arch Clin Cases. 2025;12(3):110-118. Published 2025 Aug 4. doi:10.22551/2025.48.1203.10322

Data Definitions

Term	Definition
Study period	2016 to 2025
Study population: inclusion	Patients who in a calendar year had: • Aged 45 to 64 • An **outpatient face-to-face visit** in the year as well as the year prior • At least one BMI reading in the year between 10 and 200 • Their first diagnosis for **MASLD** That calendar year is their index year
Study population: exclusion	Patients with: • **Hepatitis** in the **index year** or prior • An **alcohol-related disorder** in the **index year** or prior • An **amputation** in the **index year** or prior • **Tamoxifen** in the **index year** or prior
Stratifications	Patients with an instance of the following diagnoses in the two years prior to their initial MASLD diagnosis (billing, encounter, or problem list): • Blood disorders: CCSR categories BLD001-BLD010 • Circulatory disorders: CCSR categories CIR001-CIR039 • Endocrine disorders: CCSR categories END001-END017 • Nervous system disorders: CCSR categories NVS001-NVS022 • Respiratory disorders: CCSR categories RSP001-RSP017
Outpatient face-to-face encounter	Encounter with types “Office Visit”, “Follow-up”, “Telemedicine”, “Walk-in”, “Routine Prenatal”, “Postpartum Visit”, or “Fetal Care Consult”
Index year	The year of their first **MASLD** diagnosis
MASLD	A billing, encounter, or problem list diagnosis with SNOMED code 1231824009, excluding 442685003 or 722866000
Hepatitis	A billing, encounter, or problem list diagnosis with ICD-10-CM code B15*-B19*
Alcohol-related disorders	A billing, encounter, or problem list diagnosis with ICD-10-CM code F10*
Amputations	A billing, encounter, or problem list diagnosis with ICD-10-CM code Z89.41*, Z89.44*, Z89.51*, or Z89.56* or a procedure with ICD-10-PCD code 0X6* or 0Y6*
Tamoxifen	An administration, prescription, or patient-reported medication with ATC code L02BA01

Table 1. BMI Distribution Among Patients with MASLD

BMI Classification	Percentage
Underweight	0.1%
Healthy Weight	3.5%
Overweight-Low	6.3%
Overweight-High	11.0%
Class 1-2 Obesity	52.5%
Class 3 Obesity	26.6%

Table 2. Comorbidity Rates Among Patients with MASLD by BMI Class

Condition Group	BMI	Percentage
Endocrine Disorder Rate		
	Underweight	79.2%
	Healthy Weight	79.4%
	Overweight-Low	81.4%
	Overweight-High	83.9%
	Class 1-2 Obesity	90.5%
	Class 3 Obesity	95.6%
Circulatory Disorder Rate		
	Underweight	47.5%
	Healthy Weight	56.3%
	Overweight-Low	61.4%
	Overweight-High	64.7%
	Class 1-2 Obesity	72.8%
	Class 3 Obesity	81.9%
Nervous System Disorder Rate		
	Underweight	53.3%
	Healthy Weight	48.6%
	Overweight-Low	49.8%
	Overweight-High	53.0%
	Class 1-2 Obesity	61.4%
	Class 3 Obesity	75.0%
Respiratory Disorder Rate		
	Underweight	45.0%
	Healthy Weight	41.8%
	Overweight-Low	43.7%
	Overweight-High	46.0%
	Class 1-2 Obesity	51.7%
	Class 3 Obesity	59.8%

Blood Disorder Rate		
	Underweight	41.7%
	Healthy Weight	24.2%
	Overweight-Low	21.5%
	Overweight-High	20.7%
	Class 1-2 Obesity	22.7%
	Class 3 Obesity	29.6%