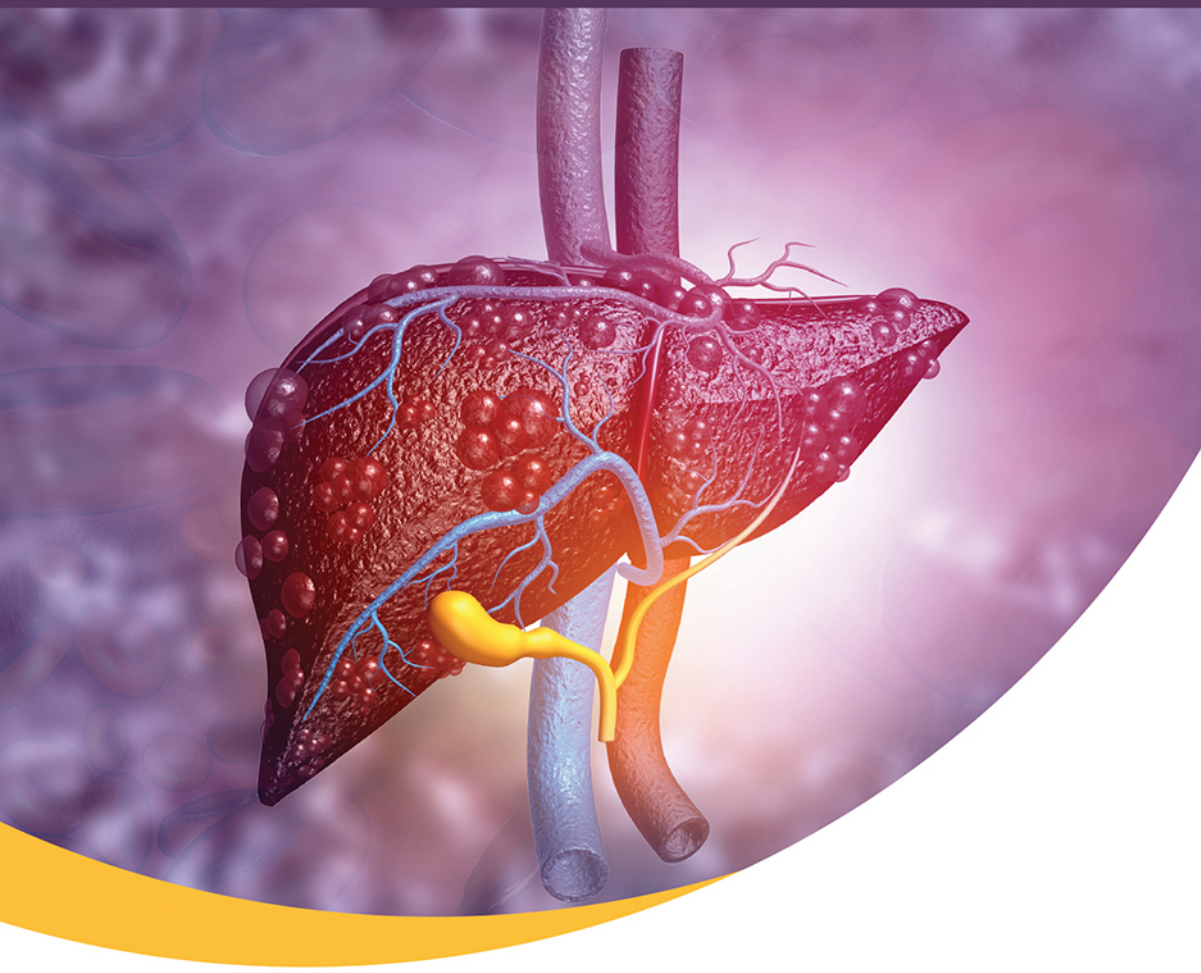

# Advances in MASLD

## A Comprehensive Guide for Physicians

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JAYPEE

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CHAPTER 2

# Epidemiology of Metabolic Dysfunction-associated Steatotic (Fatty) Liver Disease



## INTRODUCTION

Metabolic dysfunction-associated steatotic (fatty) liver disease (MASLD) is emerging as one of the most prevalent chronic liver diseases worldwide. Its increasing prevalence mirrors global trends in obesity, type 2 diabetes mellitus (T2DM), and metabolic syndrome. This chapter provides a comprehensive overview of the epidemiology of MASLD, with global and population-specific prevalence data, key risk factors, and the implications of its growing burden.

## GLOBAL PREVALENCE AND TRENDS

### Global Burden

The prevalence of MASLD is estimated to be *25–30% of the global population,* based on the metabolic risk-based diagnostic criteria. Recent analyses place the global prevalence at *32.4%,* with significant regional variations driven by obesity, diabetes, and lifestyle factors. **Table 1** outlines the prevalence of MASLD by region.

### Trends Over Time

The global prevalence of MASLD has steadily increased over the past two decades, closely tied to:

- *Obesity pandemic:* Over *650 million adults worldwide* are classified as obese, with obesity rates doubling since 1980. Approximately *70% of individuals with obesity* are estimated to have MASLD.
- *Aging populations:* Prevalence peaks in individuals aged *50–60 years*, reflecting the cumulative effects of metabolic dysfunction.
- *Urbanization and sedentary lifestyle:* Increased sedentary behavior and high-calorie diets are significant contributors, particularly in developing countries.

**TABLE 1: Global prevalence of MASLD by region.**

| Region | Prevalence (%) | Key contributors |
|---|---|---|
| North America | 35–40 | High obesity and T2DM rates; Hispanic populations are disproportionately affected due to genetic factors |
| Europe | 20–30 | Variations across Western and Eastern Europe; Mediterranean diet lowers risk in some regions |
| Middle East and North Africa (MENA) | 35–40 | Cultural dietary patterns rich in saturated fats; high physical inactivity rates |
| Asia | 15–35 | Urbanization and economic growth; dietary patterns rich in carbohydrates and sugars |
| Sub-Saharan Africa | 10–15 | Lower obesity rates; increasing prevalence due to urbanization and Westernization |
| Oceania | 25–30 | High rates in indigenous populations due to genetic susceptibility and socioeconomic factors |

[MASLD: metabolic dysfunction-associated steatotic (fatty) liver disease; T2DM: type 2 diabetes mellitus]

### Forecasted Growth

Projections indicate a *10–15% increase in prevalence by 2030,* driven by rising rates of obesity, aging populations, and broader recognition of metabolic dysfunction under the MASLD definition.

## POPULATION-SPECIFIC DATA

### North America

- *Prevalence:* 35–40%
- *Key features:* North America reports the highest prevalence, primarily due to high obesity (42%) and T2DM rates. Hispanic populations are disproportionately affected due to genetic factors such as *PNPLA3 polymorphisms*.

### Europe

- *Prevalence:* 20–30%
- *Key features:* Western Europe has higher rates than Eastern Europe. Mediterranean countries benefit from protective effects of the Mediterranean diet, which reduces liver fat accumulation.

### Asia

- *Prevalence:* 15–35%
- *Key features:* Urban areas report significantly higher prevalence (30–35%) compared to rural areas (15–20%). High carbohydrate diets and increasing metabolic syndrome rates are key drivers.

### Middle East and North Africa

- *Prevalence:* 35–40%
- *Key features:* Cultural factors, including diets high in saturated fats and low physical activity levels, contribute to high prevalence rates.

### Sub-Saharan Africa

- *Prevalence:* 10–15%
- *Key features:* Lower obesity rates explain lower prevalence, but rapid urbanization is increasing the burden of metabolic disorders.

### Oceania

- *Prevalence:* 25–30%
- *Key features:* Indigenous populations have significantly higher prevalence rates (up to 50%) due to genetic susceptibility and socioeconomic disparities **(Table 2)**.

## ASSOCIATED RISK FACTORS

Metabolic dysfunction-associated steatotic liver disease shares a multifactorial etiology, with several metabolic, genetic, and lifestyle-related risk factors playing pivotal roles. Obesity stands out as the most significant contributor, with around 70% of obese individuals estimated to have MASLD. Type 2 diabetes mellitus (T2DM) is another critical driver, with over half of diabetic individuals showing hepatic steatosis. Insulin resistance acts as a central pathogenic mechanism, linking MASLD with dyslipidemia, hypertension, and atherogenesis. Age influences prevalence, with the disease peaking between 50–60 years, correlating with accumulated metabolic insults over time. Gender differences are notable, with men showing higher prevalence, although the gap narrows post-menopause due

**TABLE 2: Key risk factors for MASLD.**

| Risk factor | Impact | Details |
|---|---|---|
| Obesity | Major contributor to MASLD | ~70% prevalence in obese individuals |
| Type 2 diabetes mellitus | Strong predictor of MASLD | >50% prevalence in diabetic populations |
| Age | Higher prevalence in older adults | Peaks in the 50–60-year age group |
| Gender | Higher in men; increases in postmenopausal women | Hormonal changes contribute to risk |
| Genetic predisposition | Increases susceptibility | Variants in PNPLA3, TM6SF2, and MBOAT7 |
| Urbanization | Contributes to sedentary lifestyles and high-calorie diets | Particularly impactful in developing countries |

[MASLD: metabolic dysfunction-associated steatotic (fatty) liver disease]

to hormonal shifts. Genetic predisposition, including polymorphisms in genes such as *PNPLA3, TM6SF2*, and *MBOAT7*, increases susceptibility, particularly in populations like Hispanics. Urbanization and sedentary lifestyles significantly contribute, especially in developing nations, due to increased caloric intake and reduced physical activity. Certain drugs (e.g., corticosteroids, NSAIDs, reverse transcriptase inhibitors) and alcohol, even at moderate levels, can exacerbate MASLD when combined with metabolic dysfunction. Rare conditions such as lysosomal acid lipase deficiency, hypobetalipoproteinemia, and mitochondrial fatty acid oxidation defects also elevate risk. Collectively, these factors create a complex interplay that drives the global rise of MASLD and underscores the need for integrated risk assessment and targeted prevention strategies.

## GLOBAL IMPLICATIONS

### Healthcare and Economic Burden

- Rising MASLD prevalence is expected to strain healthcare systems, particularly in managing advanced liver disease, including cirrhosis and hepatocellular carcinoma (HCC).
- The annual cost of managing MASLD in the United States alone is projected to exceed *$103 billion.*

### Public Health Priorities

- *Early screening and diagnosis:* Implementing noninvasive diagnostic tools, such as FibroScan and FIB-4, to identify at-risk populations.
- *Targeted prevention strategies:* Focusing on lifestyle interventions to address obesity and metabolic syndrome.
- *Multidisciplinary approach:* Coordinating care across hepatology, endocrinology, and primary care disciplines.

## CLINICAL PEARLS

- *Metabolic dysfunction-associated steatotic (fatty) liver disease affects nearly one-third of the global population,* making it a critical public health issue.
- The redefinition of MASLD has improved diagnostic inclusivity, emphasizing metabolic dysfunction.
- Regional variations in prevalence underscore the need for tailored prevention strategies.
- Obesity and T2DM are the strongest drivers of MASLD, emphasizing the importance of addressing metabolic risk factors.

## CONCLUSION

Metabolic dysfunction-associated steatotic (fatty) liver disease has become a global epidemic, driven by the rising prevalence of obesity, T2DM, and urbanization. Understanding the epidemiology of MASLD is crucial for

developing targeted public health strategies and improving clinical outcomes. By focusing on early detection, prevention, and multidisciplinary management, healthcare systems can mitigate the impact of this growing burden.

## SUGGESTED READINGS

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2. Umasankari S, S Aishwarya, SK Aishwarya, Bhardwaj S, RB Pavithra, Ray S, et al. Exploring the epidemiology and awareness of metabolic dysfunction-associated steatotic liver disease (MASLD) among health sciences students in an academic health care institute in India. Metabol Open. 2024;24:100325.

# Advances in MASLD

## A Comprehensive Guide for Physicians

Salient Features

- *Comprehensive and clinically relevant:* Covers all key aspects of metabolic dysfunction-associated fatty liver disease (MAFLD)—from historical evolution and pathophysiology to diagnosis, treatment, and long-term management—tailored for everyday clinical practice.
- *Evidence-based and up-to-date:* Integrates the latest guidelines, research, and therapeutic innovations, including emerging pharmacotherapies such as resmetirom and glucagon-like peptide 1 (GLP-1) agonists.
- *Diagnostic and management tools:* Offers detailed guidance on noninvasive diagnostic techniques [e.g., fibrosis-4 (FIB-4), elastography, magnetic resonance imaging-proton density fat fraction (MRI-PDFF)] and practical algorithms for fibrosis staging and patient's risk stratification.
- *Special population coverage:* Dedicated chapters on MAFLD in children, adolescents, pregnancy, and advanced disease stages including cirrhosis and hepatocellular carcinoma.
- *Multidisciplinary and personalized approach:* Highlights the role of endocrinologists, dietitians, primary care providers, and personalized medicine based on genomic profiles.
- *Public health perspective:* Includes critical discussion on cost-effective screening strategies, preventive healthcare policy, and future directions with a focus on Indian and global healthcare settings.

**Shambo Samrat Samajdar** is a highly accomplished Clinical Pharmacologist and Therapeutics Specialist with an MBBS, MD, DM in Clinical Pharmacology, a Diploma in Allergy Asthma Immunology (Gold Medal), and a Fellowship in Respiratory and Critical Care from WBUHS. Renowned for his expertise in diabetes and allergy-asthma therapeutics, he has published over 110 articles in indexed journals and authored more than 60 book chapters. He serves as a Consultant Physician at the Diabetes and Allergy-Asthma Therapeutics Specialty Clinic and Allergy Asthma Treatment Centre in Kolkata, West Bengal, and as a faculty member at JMN Medical College and Hospital, Nadia, West Bengal, India. Dr Samajdar has been honored with numerous awards, including the Indian Academy of Diabetes Innovation Award 2022 and the RSSDI USV Innovation Award 2024. His contributions to research and patient care have established him as a leader in his field.

**Sanjay Bandyopadhyay** MD DNB DM(Gastroenterology) MNAMS FACP(USA) FRCP(Glasgow, London), is a Senior Gastroenterologist, Academician, and Director of the Kolkata Gastro Care Foundation. A university topper and Harvard-certified specialist, he has served as an Associate Professor at Institute of Post Graduate Medical Education and Research (IPGME&R) and held key roles in national medical societies. With over 48 PubMed-indexed publications (36 as first author), he is renowned for his contributions to hepatology, metabolic dysfunction-associated fatty liver disease (MAFLD), and gastrointestinal diseases. Dr Bandyopadhyay is dedicated to advancing liver health through evidence-based care, clinical research, and multidisciplinary education.

**Rupak Chatterjee** MBBS(Hons, Triple Gold Medalist) MD(Tropical Medicine, Gold Medalist, WBUHS Topper) is a Distinguished Physician with a Stellar Academic Record. An alumnus of the College of Medicine and Sagore Dutta Hospital, Kolkata, West Bengal, India, he earned honors in 12 MBBS subjects and received Gold Medals in pharmacology, pathology, and medicine. He completed his MD in Tropical Medicine at the Calcutta School of Tropical Medicine, achieving the highest marks in the subject's history and earning a Gold Medal as the WBUHS Topper. With certifications in Critical Care and Diabetes, Dr Chatterjee has a keen interest in endocrinology and infectious diseases. He has authored 62 publications in esteemed indexed journals, including BMJ, JRCPE, PMJ, and AJM. His exceptional academic achievements and research contributions make him a valued expert in the fields of medicine and diabetes care.

**Shashank R Joshi** MD DM FICP FACP(USA) FACE(USA) Hon DSc(Medicine) FRCP(London, Glasgow, Edinburgh), is a towering figure in the field of endocrinology and a Padmashri Awardee, recognized for his pioneering work in diabetes, thyroid disorders, and metabolic health. Currently practicing at Joshi Clinic, Lilavati Hospital, and Sir HN Reliance Foundation Hospital, Mumbai, Maharashtra, India, he has held several prestigious positions, including Past-Chair of the International Diabetes Federation (Southeast Asia), President of the Indian Academy of Diabetes, President of the Indian Thyroid Society (2023–2024), and Past-Dean of the Indian College of Physicians. He has also served as Past-President of the Association of Physicians of India (API), Endocrine Society of India, Research Society for the Study of Diabetes in India (RSSDI), All India Association for Advancement of Research in Obesity (AIAARO), and the International College of Nutrition, while also being the Founder Vice-President of the PCOS Society and Past-Chapter Chair (India) for the American Association of Clinical Endocrinology. A distinguished academician, Dr Joshi is the Emeritus Editor of JAPI and Editor of the API Textbook of Medicine, and his prolific contributions to medical literature have significantly influenced endocrinology and internal medicine. Recognized internationally, he holds the title of Master of the American College of Endocrinology (MACE) and an Honorary Doctor of Science (DSc) in Medicine, along with Fellowships from the Royal Colleges of Physicians in London, Glasgow, and Edinburgh. His leadership in professional societies and editorial boards, combined with his relentless advocacy for public health, has earned him global acclaim. Dr Joshi's exceptional career, enriched by numerous accolades and pioneering initiatives, stands as an inspiration to medical professionals worldwide, exemplifying excellence in clinical practice, research, and education.

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