



From Clinic to Community: A Public Health Framework for Metabolic Dysfunction-associated Steatotic Liver Disease Prevention in India

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ABSTRACT

Background: India is witnessing a rapid rise in metabolic dysfunction-associated steatotic liver disease (MASLD), driven by the country's expanding population with obesity, type 2 diabetes (T2D), and other metabolic comorbidities. Despite this growing burden, structured liver disease screening is absent from routine noncommunicable disease (NCD) services at the primary care level.

Problem: A majority of MASLD diagnoses in India occur only after progression to advanced fibrosis or cirrhosis, even among individuals regularly engaged with healthcare systems for diabetes or hypertension. Primary health centers (PHCs) and community health centers (CHCs) currently lack standardized protocols for liver risk stratification, leading to critical missed opportunities for early intervention.

Approach: This article outlines a scalable, systems-integrated model for community-based liver care, piloted at the All India Institute of Medical Sciences (AIIMS), Rishikesh. The model incorporates noninvasive fibrosis scoring tools (FIB-4, APRI), selective deployment of nurse-led FibroScan services, maternal hepatitis B virus screening, lifestyle modification strategies, and digital follow-up systems—seamlessly embedded within existing maternal health and NCD platforms.

Insights: A real-world vignette from an urban diabetes outreach program in Kolkata illustrates the diagnostic gap: a high-risk patient remained undiagnosed for MASLD despite multiple healthcare encounters. International experiences, such as the Gwent model in Wales, further reinforce the feasibility of decentralized hepatology through community triage, nurse-led services, and simplified biochemical tools.

Conclusion: India stands at a pivotal moment in redefining hepatology as a preventive, public health-oriented discipline. By embedding liver screening within existing NCD frameworks, leveraging task-sharing, and mobilizing digital infrastructure and public-private partnerships, India can develop a replicable model for early MASLD detection and intervention. This community hepatology framework—if scaled nationally—has the potential to position India as a global leader in MASLD prevention for low- and middle-income countries.

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INTRODUCTION: THE MASLD EPIDEMIC IN INDIA

India, home to more than 130 million individuals living with obesity, type 2 diabetes (T2D), or both, is confronting an accelerating epidemic of metabolic liver disease.^{1–3} Historically, liver-related mortality in the region was driven by viral hepatitis. However, this paradigm is rapidly shifting. Metabolic dysfunction-associated steatotic liver disease (MASLD) has now emerged as the leading cause of chronic liver disease globally, and India is poised to bear a disproportionate share of this burden.³

Despite this shift, MASLD frequently goes unrecognized until the onset of advanced fibrosis or cirrhosis. Alarming, this often occurs despite multiple interactions with the healthcare system for coexisting metabolic conditions. The lack of systematic liver risk assessment at the level of primary health

centers (PHCs) and community health centers (CHCs) represents a critical missed opportunity.

This emerging crisis reflects more than just an epidemiological transition. It underscores a failure to integrate hepatology into India's broader noncommunicable disease (NCD) control strategy, where diabetes, hypertension, and cardiovascular risks are prioritized, but liver health is conspicuously absent.

REAL-WORLD ILLUSTRATION: MISSED MASLD DETECTION IN ROUTINE CARE

A real-world case from North Kolkata underscores persistent gaps in the early detection of metabolic dysfunction-associated steatotic liver disease (MASLD) within India's primary care system. A 44-year-old woman, residing in an underserved

urban locality and living with T2D for nearly a decade, presented repeatedly to healthcare facilities over a 3-year period with symptoms including fatigue and dyspepsia. Despite at least seven clinical visits to different providers, no liver-related investigations were initiated during this time.

Her diagnosis of advanced liver fibrosis (F3–F4) occurred only when she participated in a mobile diabetes outreach initiative that incorporated point-of-care liver stiffness assessment via FibroScan. Until this point, liver risk had not been addressed—despite her longstanding T2D, a well-established risk factor for MASLD.

This scenario is not isolated. Multiple studies have documented the underdiagnosis of MASLD in patients with T2D, particularly within fragmented care systems lacking structured screening algorithms. One recent global consensus emphasized that 50–70% of individuals with T2D have concurrent MASLD, yet the majority remain undiagnosed in standard NCD programs due to the absence of embedded fibrosis risk stratification protocols.⁴

Following her diagnosis, the patient was linked to specialist care and enrolled in a multidisciplinary lifestyle counseling program—an outcome contingent on the community initiative, not standard clinical care.

This case illustrates the need for urgent integration of MASLD screening into routine diabetes and hypertension pathways. Without such alignment, high-risk individuals

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continue to fall through the cracks—resulting in missed opportunities for early intervention and disproportionate escalation of healthcare costs and liver-related morbidity.

OPERATIONALIZING PREVENTIVE HEPATOLOGY: THE AIIMS RISHIKESH MODEL

In response to India's rising MASLD burden and the absence of structured liver care integration within primary health services, the All India Institute of Medical Sciences (AIIMS) Rishikesh has conceptualized and implemented a Preventive Hepatology framework within its Department of Community and Family Medicine.⁵ This initiative represents one of the country's first systematic efforts to decentralize liver disease prevention using public health infrastructure.

The model encompasses several key operational elements:

- **Noninvasive risk stratification:** Liver fibrosis risk is evaluated using widely validated, low-cost, noninvasive tools—such as FIB-4 and APRI—embedded into clinical workflows at antenatal care (ANC) and noncommunicable disease (NCD) clinics.
- **Point-of-care technology deployment:** Vibration-controlled transient elastography (FibroScan) is selectively deployed in peripheral clinics and community health initiatives, enabling early-stage fibrosis detection without tertiary referral.
- **Task-shifting to interdisciplinary teams:** Screening and counseling are led by trained nursing staff and supported by a team of physiotherapists, public health practitioners, and dietitians—demonstrating scalable models of task delegation in resource-limited settings.
- **Maternal hepatitis B screening and immunoprophylaxis:** The program includes universal maternal HBV testing and administration of timely birth-dose vaccination, aligned with WHO's hepatitis elimination goals.
- **Lifestyle and digital integration:** Patients at risk receive structured lifestyle modification counseling and digital follow-up through a mobile-enabled tracking system, designed to promote continuity of care and remote monitoring.

Although formal program evaluation is ongoing, this model has shown early feasibility and system alignment, particularly within India's National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS). By embedding

liver health into existing maternal and metabolic services, AIIMS Rishikesh offers a replicable template for other institutions and states.

Notably, the framework aligns with international guidelines from the World Health Organization (WHO) and the British Society of Gastroenterology (BSG), both of which recommend integrating early liver disease risk stratification into primary care settings.^{6,7} Similarly, the American Association for the Study of Liver Diseases (AASLD) emphasizes noninvasive diagnostics, behavioral interventions, and multidisciplinary delivery as core principles of MASLD care across diverse health systems.⁸

This program underscores the viability of a community-centric liver care model in low- and middle-income countries (LMICs)—offering a scalable, evidence-informed strategy to address the metabolic liver disease epidemic.⁵ Figure 1 illustrates the core components of India's community-based MASLD prevention framework, highlighting risk stratification, nurse-led diagnostics, maternal screening, digital follow-up, and integration into existing NCD programs.

Toward Integrated, Equitable Hepatology Services

India's National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) presents a timely and strategic opportunity to incorporate liver disease screening into the country's broader NCD infrastructure.⁹ Given the shared metabolic etiology of MASLD with type 2 diabetes, hypertension, and obesity, a unified public health strategy is both operationally feasible and economically prudent.

A forward-looking, community-anchored framework for MASLD prevention and control should include the following components:

- **Workforce enablement:** Strengthen the capacity of frontline workers—Accredited Social Health Activists (ASHAs) and Auxiliary Nurse Midwives (ANMs)—to identify at-risk individuals using simplified, community-appropriate criteria (e.g., elevated BMI, waist circumference, or coexisting T2D/hypertension).
- **Integrated risk stratification:** Embed validated liver risk algorithms (e.g., FIB-4, APRI, AST: ALT ratios) into routine workflows at primary health centers (PHCs) and community health centers (CHCs)—alongside established NCD screening and follow-up protocols.
- **Digital surveillance infrastructure:** Establish longitudinal liver health

registries to enable individual-level tracking, fibrosis risk stratification, and system-wide referral coordination. This also facilitates real-time program monitoring and research.

- **Multisectoral resource mobilization:** Leverage corporate social responsibility (CSR) funding, nongovernmental organization (NGO) engagement, and public-private partnerships to expand access to key diagnostics—such as portable FibroScan units and serological tests (HBV/HCV)—as well as to support awareness campaigns in high-burden regions.

Importantly, this approach calls for a paradigm shift in hepatology practice. The discipline must move beyond its traditional confines within tertiary-care, hospital-centric systems and embed itself horizontally across the public health continuum. For MASLD—a disease that evolves silently and intersects deeply with metabolic and social determinants—prevention must begin at the community level, not at the stage of irreversible liver injury.

By aligning hepatology with India's robust NCD framework, the country has the opportunity not only to improve early detection and intervention, but also to establish a scalable model for low- and middle-income countries (LMICs) navigating similar epidemiologic transitions.

POLICY AND PROFESSIONAL REORIENTATION

The rapid emergence of metabolic dysfunction-associated steatotic liver disease (MASLD) as the predominant cause of chronic liver disease—both globally and in India—marks a critical inflection point for the discipline of hepatology. The prevailing model, which confines liver care largely to tertiary-care settings, is increasingly insufficient in addressing a condition that is silent, progressive, and fundamentally metabolic in origin.

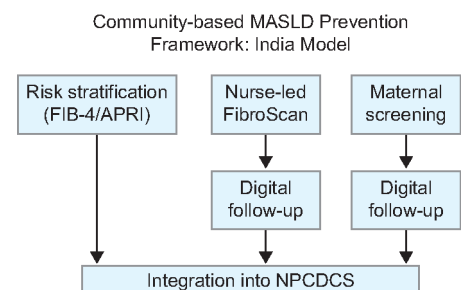


Fig. 1: Community-based MASLD prevention framework: India model

To deliver equitable, preventive, and system-wide liver care, hepatology must evolve from a specialist-centric, hospital-based domain into a public health-integrated specialty, embedded across levels of care. This transformation is supported by recent expert consensus from Indian endocrinologists and hepatologists, which emphasizes early screening, primary-level fibrosis risk stratification, and multidisciplinary community-based management of MASLD in individuals with type 2 diabetes.⁴

To institutionalize this reorientation, three strategic policy and training reforms are urgently required:

- *Formal recognition of preventive hepatology as a subspecialty:* A dedicated subspecialty in preventive hepatology, under the umbrella of the National Health Mission (NHM) and NPCDCS, would provide the necessary institutional scaffolding for integrating liver health into national health priorities. This recognition would:
 - Enable structured curricula emphasizing decentralized liver care, including population-based screening and risk stratification;
 - Facilitate targeted programmatic funding and infrastructure allocation for MASLD prevention;
 - Encourage a new cadre of hepatologists trained in community-facing and preventive frameworks.
- This aligns with the Indian MASLD Consensus recommendations, which advocate for proactive identification of MASLD among individuals with diabetes and other metabolic risks.⁴
- *Incentivized engagement of hepatologists in primary care and NCD platforms:* Bringing hepatology expertise closer to underserved populations requires system-level incentives that embed hepatologists within primary health centers (PHCs), community health centers (CHCs), and Ayushman Bharat Health and Wellness Centers. Mechanisms may include:
 - Institutional mandates require medical colleges and academic hospitals to participate in district-level hepatology outreach.
 - Telementoring programs (e.g., ECHO model) to link hepatology specialists with rural providers.
 - Integration of hepatology into NCD clinic workflows, supported by simplified screening tools and referral algorithms.

Such engagement would support earlier MASLD detection, slow fibrosis progression, and reduce tertiary-care dependence—echoing both Indian and international MASLD management frameworks.

• *Embedding public health competency in hepatology training:* As hepatology expands its scope to intersect with NCD control, fellowship programs must evolve to equip future hepatologists with the tools for population health impact. Core competencies should include:

- Epidemiology, screening program design, and burden estimation.
- Health systems and implementation science, with a focus on cost-effective, scalable interventions.
- Behavioral and lifestyle medicine, including motivational interviewing and community engagement.

This transition aligns with ongoing reforms by the National Medical Commission (NMC) to integrate public health, communication, and systems-based practice into specialty training pathways, ensuring that emerging hepatologists can lead prevention strategies in both clinical and community domains.

In sum, reimagining hepatology through a policy-aligned, professionally reoriented, and publicly engaged lens is not only timely—it is essential. Without this shift, hepatology risks remaining reactive and exclusionary, intervening only after irreversible disease progression. Conversely, a preventive, integrated approach will enable India to build a liver care model that is scalable, inclusive, and globally relevant.

CONCLUSION: TOWARD GLOBAL LEADERSHIP IN MASLD PREVENTION

In the era of metabolic dysfunction-associated steatotic liver disease (MASLD), hepatology must undergo a paradigmatic shift—from a reactive, tertiary-based specialty to a proactive, community-integrated discipline. With more than 130 million Indians living with obesity or type 2 diabetes, the country sits at the epicenter of a rising tide of metabolic liver disease.

Fortunately, India's robust public health infrastructure—including the National Health Mission (NHM), Ayushman Bharat Health and Wellness Centers, and the National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke

(NPCDCS)—offers a unique opportunity to mainstream liver care into population-level strategies. Embedding MASLD risk stratification into routine NCD workflows, leveraging task-sharing models, and expanding digital health tools can collectively shift the diagnostic curve toward early detection and intervention.

This transformation is not only clinically urgent but also ethically essential. The integration of liver health within primary care reflects a commitment to health equity—ensuring that the benefits of early MASLD detection are not confined to urban tertiary hospitals but reach the underserved millions most at risk.

With strategic investments—through CSR funding, international partnerships (e.g., World Bank), and alignment with NHM budgetary priorities—India is positioned to lead by example. This community-based framework offers a replicable template for other low- and middle-income countries (LMICs) navigating similar epidemiological transitions.

With the right systems in place, India can pioneer a globally relevant model for MASLD prevention—grounded in community health and equity. The time to act is now.

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