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Review Article

Mash in Mexico: Diagnostic Evolution, Epidemiologic Impact and Data Gaps to Estimate Cost Implications

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Abstract

Metabolic dysfunction–associated steatohepatitis (MASH) is the clinically consequential phenotype within the MASLD spectrum, with prognosis and future disease burden closely tied to fibrosis progression. In public-sector settings, the realized health and economic impact of MASH depend not only on disease biology but also on the ability of health systems to identify at-risk individuals, stage disease accurately, confirm advanced fibrosis when needed, and link patients to timely, sustained management, including pharmacologic care where indicated. This structured narrative review and policy-oriented opinion describes the current understanding of MASH and its relationship to MASLD, the evolution of diagnostic approaches toward non-invasive testing and risk stratification, and the epidemiologic rationale for prioritizing secondary prevention. It also outlines the information required to quantify the cost impact of inadequate diagnosis and/or insufficient coverage, with emphasis on Mexico's context. Mexico-specific population risk inputs are contextualized using ENSANUT Continua 2024 [1], while decision-grade cost modelling further requires system-level evidence on diagnostic "cascade" performance, time-to-staging and time-to-treatment, treatment linkage/persistence, and downstream utilization patterns [2-5].

Keywords: MASH; MASLD; Mexico; Diagnosis; Fibrosis staging; Access; Coverage; Cost impact

Introduction

MASH refers to steatohepatitis occurring in the setting of metabolic dysfunction and is now framed within the MASLD classification system [6]. This conceptual shift matters for policy because it links disease risk to population-level metabolic drivers-particularly obesity and type 2 diabetes-while also reinforcing that clinical severity is strongly linked to fibrosis stage rather than to hepatic fat alone [6,7]. In economic terms, the "access" challenge in MASH often begins well before pharmacotherapy. Individuals may not enter care early enough for fibrosis staging; risk stratification may be applied inconsistently across levels of care; and diagnostic results may fail to translate into feasible eligibility decisions and timely treatment initiation in public-sector pathways. These gaps are central to cost estimation because they determine how many patients actually receive stage-appropriate care within the time window when it is most likely to influence disease trajectory.

Mexico is an important context for this policy question. ENSANUT Continua 2024 reports high cardiometabolic exposure among adults: obesity prevalence is 38.9% (approximately 41% in women and 33% in men) [1]. Overweight is 37.3%, and when overweight and obesity are combined, the prevalence of overweight adults in Mexico exceeds 75%. Type 2 diabetes prevalence for the 2021–2024 period is estimated at 17.0%, with 11.6% diagnosed and 5.4% unaware [1]. High blood pressure affects approximately 29.9% of adults, and nearly 43% of those individuals are unaware until diagnosed [1]. These figures do not quantify MASH prevalence directly, but they support the expectation of a large at-risk population in which deficiencies in staging and linkage-to-care can translate into preventable progression to advanced liver disease.

This is consistent with broader evidence that MASLD/NAFLD remains common and is projected to drive increasing liver-related burden over time [8,9].

Methods

This paper is a structured narrative review and policy-oriented opinion. Rather than conducting a formal systematic review or meta-analysis, it synthesizes policy-relevant sources on MASLD/MASH definitions and diagnostic approaches [6,10], epidemiologic modelling supporting the importance of fibrosis progression [8,9,11], and health-economic methods that structure cost and budget-impact evaluation in decision models [2-5]. Mexico-specific context is introduced using ENSANUT Continua 2024 cardiometabolic prevalence and undiagnosed disease indicators to support population-risk input framing 18. The main aim is to clarify which evidence is needed to estimate the cost impact of inadequate diagnosis and/or insufficient coverage in public-sector pathways.

Results

Current Status of Mash Within Masld and Why it is Policy Relevant

MASH is clinically important because it represents a steatohepatitis phenotype within the broader MASLD spectrum, with a prognosis that depends heavily on fibrosis progression [6,7]. While not all patients with MASLD develop MASH, and not all patients with MASH progress at the same rate, population-level exposure to metabolic risk factors creates a pathway to future advanced fibrosis and cirrhosis [8,9]. This "common exposure, concentrated risk" pattern is precisely what makes staging and secondary prevention central in public health planning [8,9,11].

Evolution of Diagnosis: From Histology to Non-Invasive Staging and Risk Pathways

Historically, diagnosis and fibrosis staging relied on liver biopsy and histologic scoring [7]. However, biopsy is invasive and not scalable for widespread identification of patients with advanced fibrosis. As a result, diagnostic strategies increasingly emphasize non-invasive tests and risk stratification, including guideline-supported fibrosis assessment approaches [7,10]. Blood-based fibrosis scoring systems and composite indices support triage by estimating fibrosis probability [12-14], while elastography-based methods are used to refine staging and prognosis where available [10,15]. From a cost perspective, the shift to non-invasive testing does not automatically ensure improved economic value. Diagnostic impact depends on real-world pathway implementation: test availability, performance under routine conditions, the timing of results, completion of subsequent steps, and whether staging outputs are used to enable eligibility and treatment initiation. Accordingly, economic evaluation should treat MASH access as a diagnostic "cascade" rather than as a single test accuracy problem [2,3].

Epidemiologic and Health-Impact Implications

Epidemiologic evidence and modelling studies consistently indicate that fatty liver–related disease burden is substantial and projected to grow over time, driven by population metabolic risk and progression to more severe liver disease [8,9]. Global meta-analytic and modelling work has highlighted that the future burden attributable to NAFLD/MASLD can increase markedly with continued progression patterns, reinforcing the importance of timely identification and secondary prevention [8,9,11,16]. For policy and costing, this implies that outcomes most relevant to health-care resource use and economic burden often occur downstream - particularly when patients reach advanced fibrosis stages. Therefore, any cost-impact estimate should connect staging and access decisions to future stage distributions and the probability of downstream events rather than focusing only on diagnostic or treatment costs incurred "today" [2-4].

Mexico-Specific Context: Cardiometabolic Risk and Access Constraints

ENSANUT Continua 2024 provides nationally relevant indicators of cardiometabolic risk and undiagnosed conditions that are highly relevant to MASLD/MASH risk exposure. Mexico's obesity prevalence is 38.9% (women ~41%, men ~33%). Overweight prevalence is 37.3%, and combined overweight/obesity exceeds 75%. Type 2 diabetes prevalence is 17.0% (2021–2024), with 11.6% diagnosed and 5.4% unaware. High blood pressure prevalence is ~29.9%, with nearly 43% unaware [1]. These undiagnosed proportions imply delayed metabolic risk control, which can contribute to a longer progression window before liver disease risk is recognized. While the exact fraction of this population that has MASH is not specified by ENSANUT, Mexico's cardiometabolic profile supports a large at-risk pool. The cost implication for MASH then depends on whether public-sector systems can implement fibrosis staging and translate results into eligible treatment pathways without excessive delays, loss to follow-up, or administrative friction - issues that are particularly relevant for diagnostic cascade completion and realistic time-to-treatment assumptions in economic models [2-5].

Discussion

Information Needed to Estimate the Cost Impact of Inadequate Diagnosis and Coverage

To estimate the cost implications of inadequate diagnosis and/or insufficient coverage in MASH, the evaluation must explicitly represent the pathway from population risk to diagnosed/staged disease and then to treatment linkage and downstream outcomes [2-4]. This requires five domains of information. First, the model needs population and disease distribution inputs by fibrosis risk categories. ENSANUT Continua 2024 can support cardiometabolic risk framing in Mexico [1], but mapping from metabolic risk to MASLD/MASH and fibrosis-stage distribution requires additional assumptions or validated bridging evidence [6,8,9]. Second, the model must include real-world diagnostic cascade performance. In practical terms, this means specifying probabilities of entering care, receiving risk stratification testing, completing staging steps, and avoiding loss to follow-up between steps, as well as time-to-staging and time-to-treatment. Economic evaluation guidance emphasizes that these operational elements materially influence

results because they determine how many patients benefit from timely interventions [2,3].

Third, coverage and eligibility rules must be represented as operational constraints. In public-sector systems, coverage may be conditional on fibrosis stage and may require documentation or authorization processes that affect treatment initiation. Therefore, "no coverage" and "delayed linkage to care" should be treated as system-level outcomes that interact with diagnostic staging rather than as isolated formulary decisions [4,5]. Fourth, the model needs disease progression dynamics and the relationship between fibrosis stage and downstream outcomes. When local event data are limited, progression probabilities are often sourced from broader literature and tested through sensitivity analyses [8,11,12,16]. Fifth, the model needs unit costs and resource utilization patterns, including diagnostic tests and follow-up, pharmacologic treatment and administration, and downstream utilization associated with advanced fibrosis and complications. Standard health-economic methods and budget-impact guidance provide the modelling structure to compare scenarios and quantify cost differences attributable to coverage and access limitations [2-5].

Why "Cost of no Coverage" Is Partly a Diagnostic and Pathway Problem

A frequent misconception in health economics is to interpret "cost of no coverage" as if it depended only on whether a therapy is paid for. In MASH, however, coverage decisions operate within a broader clinical and administrative pathway, and the realized benefit depends on whether patients reach the right stage of disease at the right time. When fibrosis staging is delayed, incomplete, or not acted upon consistently, eligible patients may not enter treatment early enough to meaningfully alter disease trajectory. Conversely, even when patients receive a correct diagnosis, the expected value can be reduced if referral and authorization processes introduce long waiting times, if results are not transmitted reliably between levels of care, or if there is substantial loss to follow-up between diagnostic steps. For decision-making, this means that the economic impact of limited coverage is inseparable from diagnostic performance in real-world practice and from the timeliness and efficiency of linkage to treatment. Consequently, cost evaluations should model the diagnostic-to-treatment "cascade" rather than treating diagnosis, eligibility, and treatment initiation as independent events [2-5,17,18].

In Mexico, the relevance of this interaction is reinforced by the high and largely undiagnosed burden of cardiometabolic risk captured in ENSANUT Continua 2024. With obesity prevalence at 38.9%, type 2 diabetes at 17.0% (of which 11.6% are diagnosed and 5.4% unaware), and high blood pressure affecting ~29.9% with nearly 43% unaware until diagnosis, many individuals may experience metabolic risk exposure for longer periods before the health system identifies and stages associated complications [1]. Although these indicators do not quantify MASH prevalence directly, they support the expectation that delays and gaps in diagnosis and linkage to care may be policy-relevant drivers of downstream liver outcomes. Therefore, when estimating the cost consequences of inadequate coverage in MASH, it is not sufficient to assume that diagnosis and treatment occur as designed; the evaluation should incorporate pathway bottlenecks that determine how many patients actually receive stage-appropriate care [2-4].

Mexico-Specific Data Priorities to Strengthen Cost Evaluations

To generate a decision-grade cost estimate for Mexico, the highest priority is to obtain information on how the system performs in practice-specifically, the pathway metrics that determine who gets staged, who gets treated, and when. Beyond population risk inputs, a cost model needs evidence for diagnostic cascade throughput, timing, and linkage. This includes the proportion of at-risk patients who are identified within public-sector services, the fraction who complete fibrosis risk stratification and confirmatory assessment when indicated, and the proportion lost to follow-up between diagnostic steps. Equally important are time metrics, such as average time from abnormal screening or initial suspicion to risk stratification, and time from staging results to treatment initiation. Since coverage and eligibility rules may depend on fibrosis stage, the model should also capture how administrative requirements influence time-to-treatment and the probability of treatment initiation once a patient is classified as eligible [2-5].

Finally, Mexico-specific unit costs and downstream utilization patterns are necessary to translate pathway performance into economic outcomes. This means building public-sector cost inventories for diagnostic and follow-up services (including laboratory tests and imaging/elastography where used), and estimating the resource use associated with advanced fibrosis and complications. The economic consequence of "no coverage" is largely driven by downstream health-care utilization among patients who progress without timely stage-appropriate care; therefore, the model should include costs of complications and higher-intensity management rather than focusing only on the cost of the diagnostic tests and pharmacotherapy themselves [2-5]. In this context, ENSANUT Continua 2024 remains valuable for characterizing cardiometabolic risk exposure at the population level [1], but it should be complemented by real-world service delivery and utilization data so that the economic evaluation reflects Mexican public-sector realities and not idealized clinical pathways [2-5].

Conclusion

MASH is a clinically consequential phenotype within MASLD, with major public health relevance driven by metabolic risk exposure and by the disproportionate downstream burden associated with advanced fibrosis. Diagnostic strategies have evolved toward non-invasive staging and risk stratification supported by guidelines [7,10,15]. However, the expected health and economic benefits of secondary prevention in the public sector depend on real-world implementation of the diagnostic and care pathway- especially time-to-staging, time-to-treatment, and the ability to translate staging outputs into feasible eligibility and treatment initiation.

For Mexico, ENSANUT Continua 2024 documents substantial cardiometabolic exposure among adults: obesity 38.9% (women 41%, men ~33%), overweight 37.3%, overweight/obesity >

75%, type 2 diabetes 17.0% (2021–2024) with 11.6% diagnosed and 5.4% unaware, and high blood pressure 29.9% with nearly 43% unaware [1]. These findings support the scale of the at-risk population, but they do not replace system-level evidence required to estimate cost impact. Decision-grade economic evaluation for MASH in Mexico requires additional inputs on diagnostic cascade performance, coverage and eligibility implementation, treatment linkage/persistence, and downstream utilization costs.

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