Epidemiological, Clinical, Economic, and Humanistic Burden of Metabolic Dysfunction-Associated Steatohepatitis (MASH) in the United Arab Emirates: A Markov State-Transition Modeling Study

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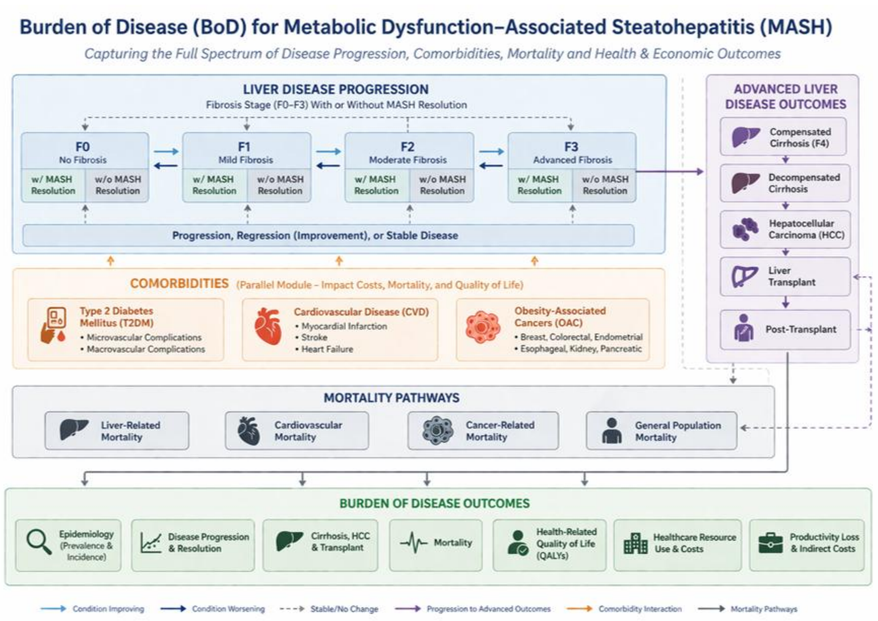
BACKGROUND

- **MASH is a progressive liver disease within the metabolic dysfunction-associated steatotic liver disease (MASLD) spectrum**, representing its more severe, inflammatory subset; in this model, **MASH is estimated to affect 8.75% of UAE adults, equivalent to approximately 855,569 diagnosed individuals.**
- **Obesity, type 2 diabetes mellitus (T2DM), and broader cardiometabolic comorbidity are the primary drivers of MASH progression**; the UAE carries a high prevalence of these risk factors, creating a large at-risk population for advanced liver disease.
- MASH follows a characteristically silent clinical course: 7% of patients already present with advanced fibrosis (F4) at the point of diagnosis, and **most remain unaware of liver disease until decompensated cirrhosis or hepatocellular carcinoma (HCC) develops.**
- Despite maturing clinical guidelines and an expanding therapeutic pipeline, **the population-level burden of MASH in the UAE had not previously been quantified using a formal health-economic framework prior to this study.**

OBJECTIVES

To quantify the burden of MASH across the disease-severity spectrum in the UAE over a 30-year lifetime horizon, adopting both payer and societal perspectives.

MODEL STRUCTURE



METHODOLOGY

- **A cohort-based Markov state-transition model** was developed to simulate the progression and burden of metabolic dysfunction-associated steatohepatitis (MASH) in patients with histological evidence of disease and baseline fibrosis stages F2 or F3.
- The model tracks a cohort of patients over a defined time horizon, during which individuals transition between mutually exclusive health states representing the natural history of MASH. **Health states are defined by fibrosis stage (F0, F1, F2, and F3) in combination with MASH resolution status (resolved vs. unresolved)**, allowing the model to capture both structural liver changes and treatment-related disease resolution.
- In addition to early-stage fibrosis states, the model includes **advanced liver disease states comprising F4 (compensated cirrhosis), decompensated cirrhosis (DCC), hepatocellular carcinoma (HCC), liver transplant, and death.** These states reflect clinically significant disease progression and are associated with increased morbidity, mortality, and economic burden.
- Transitions between health states occur at discrete time intervals (cycles) and are governed by transition probabilities informed by published literature and relevant data sources. The model captures both disease progression and potential regression (including MASH resolution), where applicable.
- **Comorbid conditions, including cardiovascular disease (CVD), type 2 diabetes mellitus (T2DM), and obesity,** may be incorporated as optional components of the model. When included, these comorbidities contribute to overall disease burden through their impact on clinical outcomes, costs, and quality of life.
- **The model framework enables estimation of epidemiological, clinical, economic, and humanistic outcomes** associated with MASH by capturing the longitudinal progression of disease and its complications in a structured and transparent manner.
- **The main source for the clinical inputs**, including patient characteristics for semaglutide and SoC, was the **clinical trial report of the ESSENCE trial Phase 3 study**, 72-week interim analysis. Clinical inputs for resmetirom were informed by an indirect treatment comparison conducted for semaglutide 2.4 mg versus resmetirom. The risk equations used to model disease progression for the comorbidities were obtained from the published literature.

MODEL SETTING & INPUT PARAMETERS

MODEL SETTINGS

Country - Currency	Discount rate - costs and health	Time horizon	Perspective	Population
United Arab Emirates - AED	3.0%	30 years (lifetime base case)	Payer and societal perspective	Adult MASH patients

INPUT PARAMETERS

Clinical inputs	Treatment Efficacy, Treatment Effects on Other Metabolic Factors, Treatment delay and Discontinuation Disease Progression: Liver Disease fibrosis progression and regression by MASH-resolution status, liver-related mortality Cardiovascular Disease : MASH-QRISK3; CVD in T2DM; first and recurrent events Type 2 Diabetes: onset and microvascular complications - nephropathy, retinopathy, neuropathy Obesity: BMI progression, obesity-associated cancer incidence: colorectal, post-menopausal breast, endometrial; mortality input
Utility inputs	Liver disease utilities by fibrosis stage and MASH resolution (F0 to F3, CC, DC, HCC, LT) Comorbidity utilities (cardiovascular disease post MI/ post stroke, T2DM, obesity) Cardiovascular event disutility (MI, stroke) Adverse events utility - general population All utilities are mapped to local UAE context
Cost components	Health-state costs (liver disease, cardiovascular disease, obesity, T2DM) Events and treatment costs (cardiovascular disease, adverse events) Indirect costs of the liver health state (F0 to F3, CC, DC, HCC, LT) Micro-costing approach is applied
HCRU	Myocardial infarction, thrombotic stroke, nephrotic syndrome, prediabetes, diabetes, retinopathy, neuropathy, cardiovascular death Cancers associated with obesity: colorectal cancer, breast cancer, endometrial cancer Micro-costing approach is applied
Outputs	**Clinical Burden**: Health State Distribution - Advanced Stage Disease (F4): Compensated Cirrhosis, Decompensated Cirrhosis, HCC, Liver Transplant - Comorbidity Condition: Obesity associated cancers, T2DM, Cardiovascular events, MI, Stroke – Mortality: Cardiovascular Death, Obesity Cancer Death, Liver Death, All Cause Mortality. **Economic Burden**: Treatment Cost (Drug acquisition costs, Administration costs, Adverse event costs), Health State cost (F0 ,F1,F2,F3,F4), Comorbidity Cost (Obesity, T2DM, Stroke event, CV Death), Indirect Cost. **Humanistic Burden**: Total life-years and Total QALYs.

BASELINE POPULATION

- The model starts from 2026; UAE population of 11,640,397, of which 84% (**9,777,933**) are adults aged 18 and over.
- Applied population growth rate: 2.02%
- Adult MASH prevalence of 8.75% is held constant across the horizon, corresponding to 855,569 prevalent cases in Year 1.
- Proportion eligible for treatment assumed at 100%.

BASELINE FIBROSIS DISTRIBUTION (n = 855,569)

	PERCENTAGE	PATIENTS
F0	21%	179,994
F1	36.5%	311,989
F2	22.4%	191,993
F3	12.6%	107,996
F4	7.4%	63,598

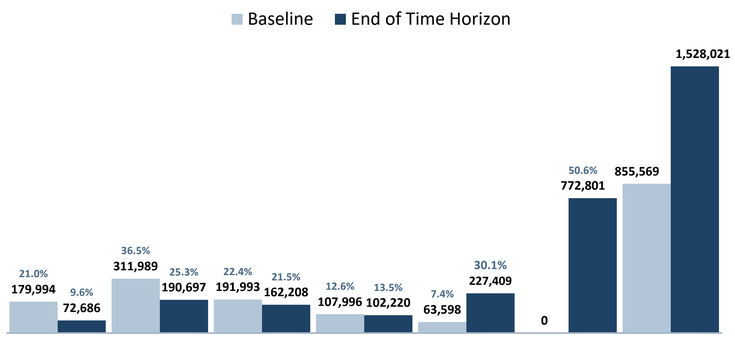
F4 SUBGROUP AT BASELINE (n = 63,598)

	PERCENTAGE	PATIENTS
CC	58%	37,089
DC	21%	13,664
HCC	18%	11,712
LT	2%	1,132

RESULTS

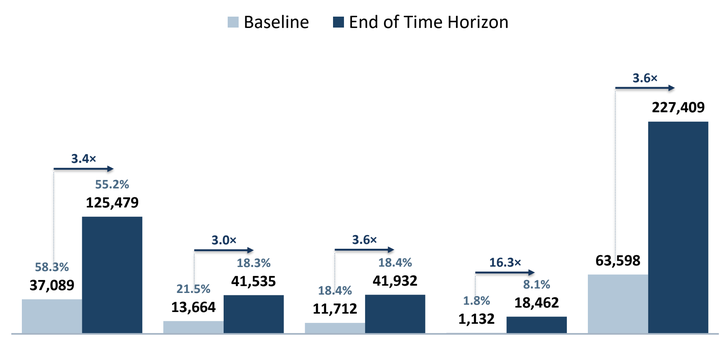
CLINICAL BURDEN Health State Distribution

Untreated MASH can progress from F2–F3 fibrosis to advanced fibrosis (F4) and death: At baseline, F2 and F3 fibrosis accounted for the majority of the 1,528,021 modeled adults with diagnosed MASH. Over the 30-year horizon, patients progressed toward advanced fibrosis, with F4 increasing to 30% of the cohort by model end. Overall, 772,801 patients (50.6%) reached the death state.



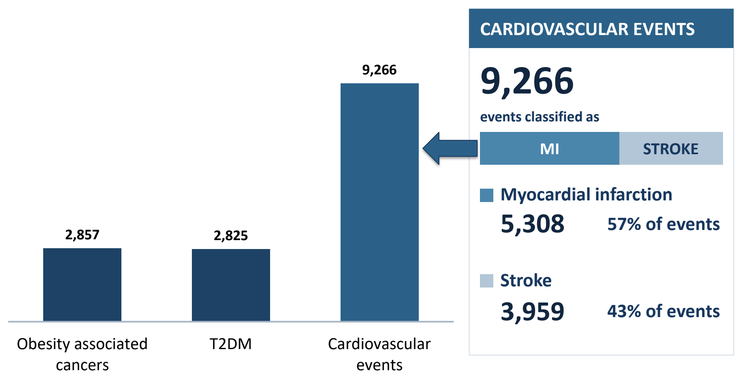
CLINICAL BURDEN Advanced Stage Disease

MASH progression is associated with a growing burden of advanced and severe liver outcomes: Over 30 years, compensated cirrhosis, decompensated cirrhosis, and HCC increased 3.4, 3.0, and 3.6-fold, respectively, while liver transplantation increased 16.3-fold. This marked shift toward more severe disease stages underscores the growing clinical burden of MASH progression.



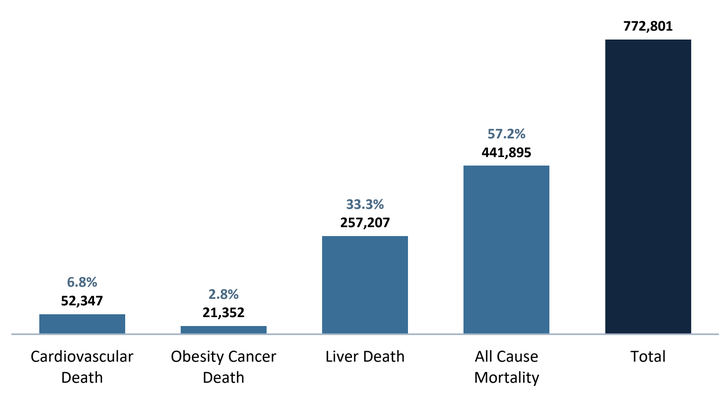
CLINICAL BURDEN Comorbidity Condition

Beyond the liver, MASH progression carries a substantial cardiometabolic and extrahepatic disease burden: Cardiovascular events represent the largest modeled comorbidity burden, reaching 9,266 events, compared with 2,825 T2DM events and 2,857 obesity-associated cancers. Within cardiovascular events, myocardial infarction accounted for 57% and stroke for 43%.



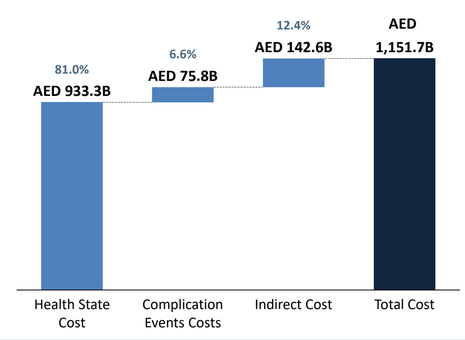
CLINICAL BURDEN Total Mortality

Mortality represents a substantial downstream burden of MASH progression: Over the 30-year horizon, 772,801 patients (50.6% of the cohort) died, with liver disease representing the leading disease-specific cause of death (257,207; 33%), followed by cardiovascular disease (7%) and obesity-associated cancer (3%). The remaining 57% were attributable to background all-cause mortality.



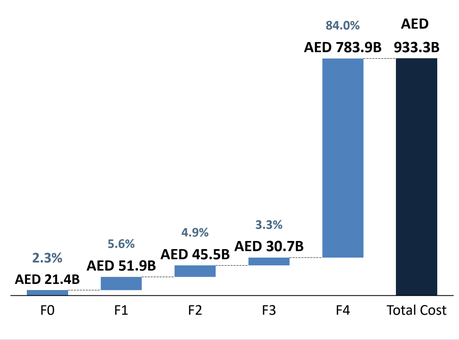
ECONOMIC BURDEN Total Economic Burden - AED billion

MASH drives an AED 1.15 trillion economic burden over 30 years, with health state costs accounting for the vast majority: AED 933.3 billion (81%) of the total burden was attributable to health state costs, followed by indirect costs (AED 142.5 billion;12%) and complication-related costs (AED 75.9 billion;7%).



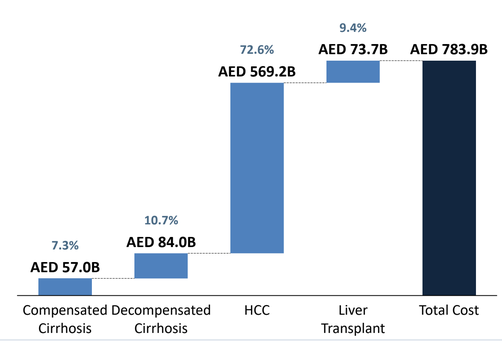
ECONOMIC BURDEN Health State Cost - AED billion

Costs escalate substantially as MASH progresses from F2–F3 fibrosis to advanced F4 disease: Health-state costs associated with F2–F3 fibrosis increase markedly with disease progression, culminating in AED 783.9 billion at F4, which accounts for 84% of the total AED 933.3 billion health-state burden over the 30-year horizon.



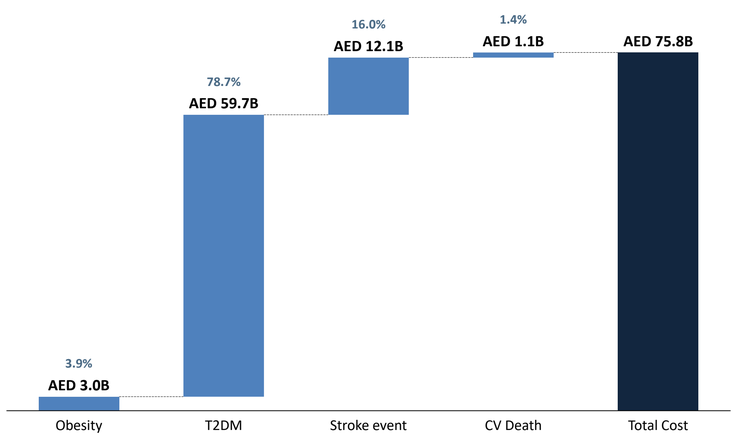
ECONOMIC BURDEN Advanced Stage (F4) Cost - AED billion

F4 disease costs are heavily concentrated in hepatocellular carcinoma: Of the AED 783.9 billion in F4 health-state costs, HCC alone accounts for AED 569.2 billion (73%), substantially exceeding decompensated cirrhosis (AED 84.0 billion), liver transplant (AED 73.7 billion), and compensated cirrhosis (AED 57.0 billion).



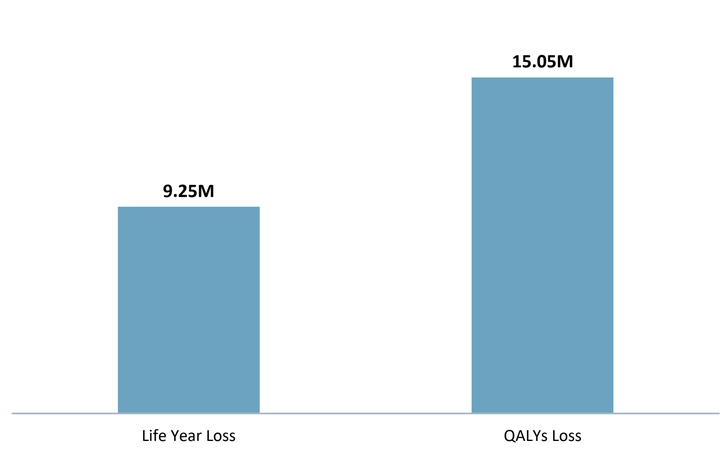
ECONOMIC BURDEN Comorbidity Cost - AED billion

MASH-related comorbidities add AED 75.8 billion to the economic burden, driven predominantly by T2DM: T2DM accounts for AED 59.6 billion (79%) of total comorbidity costs, followed by stroke at AED 12.1 billion (16%), highlighting the substantial economic impact of extrahepatic complications.



HUMANISTIC BURDEN LY Loss and QALYs Loss

MASH progression results in substantial losses in both life expectancy and quality-adjusted survival: Over the 30-year horizon, MASH is associated with 9.25 million life-years lost and 15.04 million QALYs lost, highlighting the substantial humanistic burden of disease progression.



CONCLUSION

Overall, the findings demonstrate the substantial long-term burden of MASH in the UAE, with progression from F2–F3 fibrosis to advanced F4 disease and death translating into significant clinical, economic, and humanistic consequences:

- **Disease progression and clinical impact:** Patients at baseline progressively transitioned to advanced F4 disease over the 30-year horizon, with F4 accounting for 30% of the modelled cohort by model end. Overall, 772,801 patients (50.6%) reached the death state, primarily due to liver-related causes, cardiovascular events, and obesity-associated malignancies.
- **Healthcare and economic impact:** As MASH progresses toward advanced disease, the associated health-state and complication-related costs increase substantially, contributing to a total economic burden of AED 1.15 trillion over the modelled horizon.
- **Humanistic impact:** Disease progression and its associated complications result in substantial losses in survival and quality of life, with 9.25 million life-years and 15.04 million QALYs lost over the modelled horizon.

These findings underscore the importance of earlier identification and timely intervention during F2–F3 fibrosis, before progression to F4, to potentially delay advanced disease, reduce complications and mortality, preserve quality of life, and mitigate the broader burden of MASH on patients and the UAE healthcare system.

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