Cost of Inaction for Metabolic Dysfunction-Associated Steatohepatitis (MASH): The Projected Economic Burden in the US

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BACKGROUND

- MASH is not only responsible for significant mortality and morbidity but also significant economic burden.

AIM

- Our aim was to model the economic burden of MASH in the US considering both direct-medical and societal costs.

METHODS

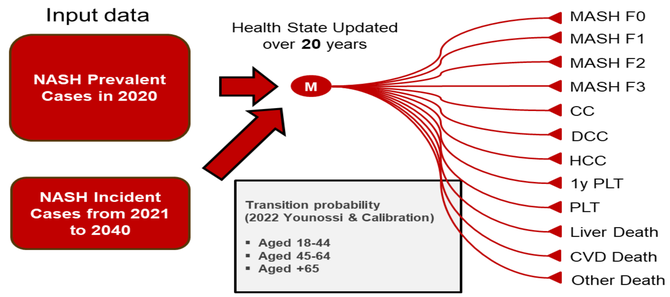
Model Structure and Data Sources:

- A Markov Model was employed to assess the direct costs, societal costs, health outcomes, and mortality associated with MASH over a 20-year period **(Figure 1)**.
- Transition probabilities for progression/regression rates were derived from a range of literature sources and registries.
- Annual cause-specific mortality for MASH across age and health states were estimated by using National Health and Nutrition Examination Survey (NHANES), global burden of disease (GBD), Global NASH council registry (GNR), Organ Procurement and Transplantation Network (OPTN), and National Vital Statistics System (NVSS).
- Age-specific transition probabilities were developed to account for variations in disease progression with age.
- Calibrations and validations against the incidence and mortality of HCC and LT rates from the GBD and OPTN were performed.

Model Clinical Input:

- In the Markov model, both prevalent and incident MASH cases serve as inputs, providing crucial data for assessing disease progression and associated outcomes over the 20-year period.
- MASH prevalence (2020) was estimated to 6.36% (16.5 million).
- Incidence of MASLD was calculated by subtracting the MASLD prevalence in 2020 (adjusted for cases that persisted to 2021) from the MASLD prevalence in 2021 obtained from GBD.
- Under the assumption that trends in MASH incidence aligned with the projected diabetes prevalence from the International Diabetes Federation (IDF) for 2021-2040, we projected MASH incidence rates (3.37 per 1,000 in 2021 to 4.33 per 1,000 in 2024).

Figure 1. Overall Model Structure



Abbreviations: MASH with no fibrosis (F0), fibrosis stages 1-3 (F1-F3), compensated cirrhosis (CC), decompensated cirrhosis (DCC), hepatocellular carcinoma (HCC), first-year post-liver transplantation (1yPLT), post-liver transplantation after 1 year (PLT), and cardiovascular disease (CVD)

- Incident MASH cases entered the model at F0.
- Prevalence and incidence cases for each individual age were derived by applying the estimated distribution of health states within each age group to the US population, thus accounting for the age demographics of the US population.

Model Cost and Utilities Input:

- A combination of micro costing and gross costing methods was employed to estimate the MASH-related direct medical costs associated with each health state.
- Societal costs was based on the estimated Work Productivity Impairment (WPI) using historical data for MASH patients and adjusted net national income per capita.
- Health utility scores, representing quality of life, were obtained from the EQ-5D for MASLD/MASH patients and SF-6D for those with decompensated liver disease.

RESULTS

- MASH cases are forecasted to increase by +28.63%, rising from 16.72 million in 2021 to 24.62 million in 2040 **(Figure 2).**
- Prevalent advanced fibrosis (F3 and CC), DCC, HCC, and LT are projected to increase by +49.18%, +51.52%, +91.48%,and +83.64% respectively, from 2021 to 2040 **(Table 1).**
- From 2021 to 2040, the projected annual direct healthcare costs and societal costs associated with MASH are projected to reach $62.34 billion and $251.98 billion, respectively **(Table 2).**

Figure 2. Projected Trends in Clinical Burden of MASH in United States, 2021-2040

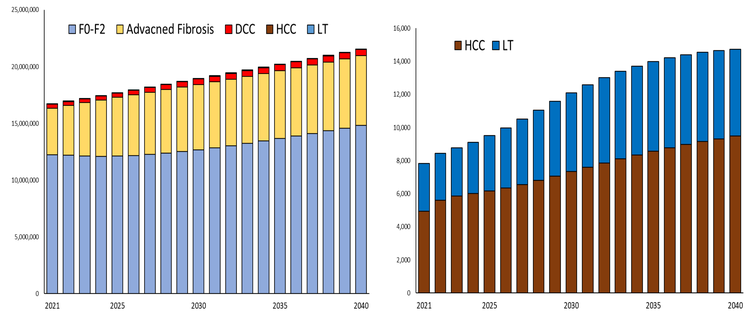


Table 1. Projected Clinical Burden of MASH in United States, 2021-2040

Year	MASH prevalence (%)	Advanced fibrosis (F3-CC) MASH Prevalence per 100,000	DCC-MASH Prevalence per 100,000	HCC-MASH rate per 100,000	Liver Transplant per 100,000	MASH-Liver Mortality per 100,000
2021	16,720 K (6.41)	4,115,302 (157.82)	355,101 (136.18)	4,951 (1.90)	2,866 (1.10)	76,454 (29.32)
2025	17,676 K (6.56)	5,177,514 (192.14)	368,063 (136.59)	6,168 (2.29)	3,340 (1.24)	75,705 (28.09)
2030	20,181 K (7.01)	5,742,696 (205.60)	483,864 (173.24)	7,339 (2.63)	4,765 (1.71)	91,112 (32.62)
2035	21,508 K (7.26)	5,956,687 (206.80)	541,710 (188.07)	8,566 (2.97)	5,434 (1.89)	102,499 (35.58)
2040	24,615 K (7.93)	6,139,218 (207.27)	538,042 (181.65)	9,480 (3.20)	5,263 (1.78)	107,854 (36.41)

Table 2. Projected Economic Burden of MASH in United Stats, 2021-2040

Year	Utilities per Patients	Direct Cost	Societal Costs	Direct Cost per Patients	Societal Costs per Patients
2021	0.8316	$22.51B	$101.64B	$1,316	$5,941
2025	0.8304	$27.64B	$122.19B	$1,561	$6,907
2030	0.8289	$38.89B	$157.33B	$2,053	$8,309
2035	0.8286	$50.76B	$199.73B	$2,513	$9,890
2040	0.8291	$62.34B	$251.98B	$2,897	$11,708

- Per patient, the projected MASH attributable direct healthcare and societal costs are expected to increase from $1,316 to $2,897 and from $5,941 to $11,708, respectively.

CONCLUSIONS

- The economic burden of MASH is expected to grow substantially over the next two decades without any action.
- Optimized strategies for MASH identification, treatment and prevention are needed to reduce the future economic burden of MASH.

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