# Economic and Humanistic Burden of Compensated Cirrhosis due to Metabolic Dysfunction-Associated Steatohepatitis (MASH) : A Systematic Literature Review

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## Introduction

- Compensated cirrhosis due to metabolic dysfunction-associated steatohepatitis (MASH) represents a substantial increase in severity versus (vs.) earlier stages, yet data in this population have not been comprehensively synthesized[1,2]
- Compensated cirrhosis due to MASH patients carries a severe risk of disease progression, including hepatic decompensation, liver transplantation, and hepatocellular carcinoma, in addition to cardiovascular and metabolic comorbidities[1–5]
- The extent to which compensated cirrhosis disease status due to MASH contributes to and exacerbates existing economic and humanistic burdens remains largely uncharacterized[2,6,7]

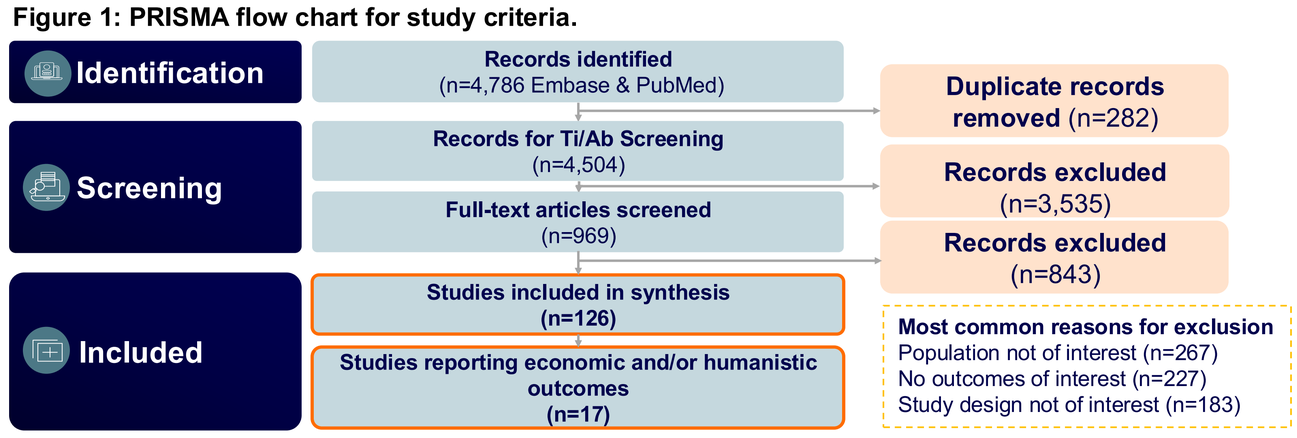
## Objectives

This systematic literature review (SLR) was conducted to characterize economic and humanistic outcomes in compensated cirrhosis due to MASH, highlighting healthcare resource use (HCRU) and disease management-associated costs, as well as patient-reported outcomes (PROs) and health-related quality of life (HRQoL) measures.

## Methods

- Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)-driven searches following Cochrane guidelines were conducted in Embase and PubMed (2017–February 2026 for articles; 2021–February 2026 for conference abstracts) **(Figure 1)**[10,11]
- Studies with adults with compensated cirrhosis due to MASH in the US, UK, France, Germany, Italy and Spain were included if they reported epidemiological, clinical, economic, or humanistic outcomes
- Title/abstract and full-text screening were performed in duplicate, and all extractions were conducted by one reviewer and independently validated by another

**Figure 1: PRISMA flow chart for study criteria.**

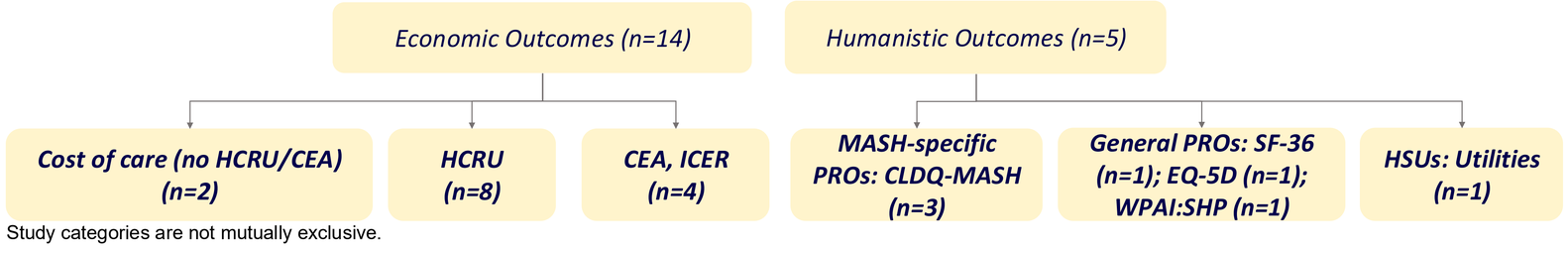



## Results

### Reported Outcomes

- A total of 17 studies reporting economic (n=14) and humanistic burden (n=5) were identified, with some studies reporting both outcomes **(Figure 2)**
- Both measures and outcomes employed across studies were heterogeneous and cannot be readily compared for cross-study analysis

**Figure 2: Studies reporting economic and humanistic outcomes**




Study categories are not mutually exclusive.

### Economic Outcomes

- Economic burden estimates were heterogeneous in data source and outcome definition, driven primarily by single-country retrospective analyses. Underlying methodologies did not permit clear attribution of all HCRU and costs specifically to compensated cirrhosis vs. other comorbidities
- US retrospective claims analysis of compensated cirrhosis patients demonstrated an increase of inpatient hospitalization and length of stay post-compensated cirrhosis due to MASH diagnosis (**13.2% vs. 9.5% of post vs. pre diagnosis** patients with **inpatient hospitalizations; 0.89 vs 0.73 mean length of stay post vs. pre diagnosis**) **(Figures 3&4)**

**Figure 3: Annual HCRU Costs per patient for compensated cirrhosis due to MASH (Wong 2021)**

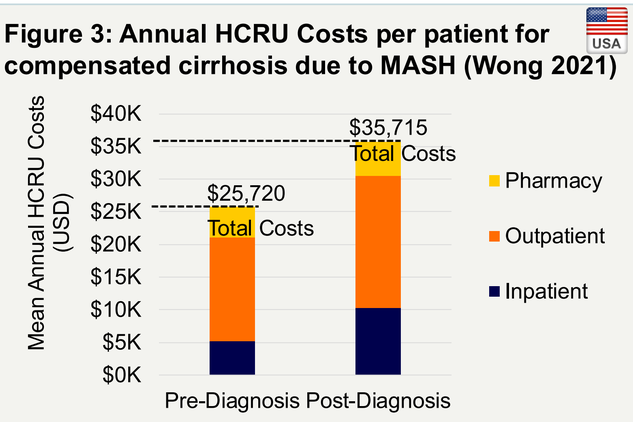
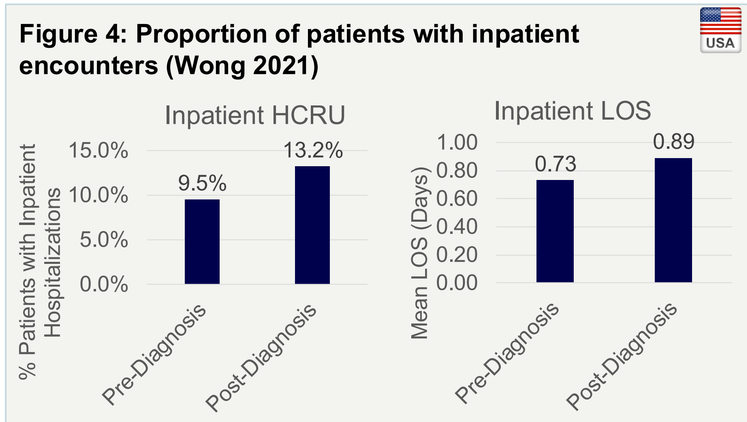



**Figure 4: Proportion of patients with inpatient encounters (Wong 2021)**




### Advanced outcomes

| | | |
|---|---|---|
| DEU | **Increased outpatient visits in the year post vs pre-index** for compensated cirrhosis due to MASH | **31.1 vs 26.9** Outpatient Visits |
| ESP | Monthly **costs were greater for decompensated vs. compensated cirrhosis** due to MASH patients | **7%:19%:23%** Increased Costs for Inpatient:Outpatient:Overall |
| FRA | Mean annual **hospitalization costs per patient were significantly greater post vs pre-index** for compensated cirrhosis due to MASH | **€10,002 vs €5,828** Hospitalization Costs |
| ITA | Hospitalization costs were **significantly greater** for post-diagnosis compensated cirrhosis due to MASH than patients without advanced liver disease | **€10,291 vs €3,818** Hospitalization Costs |

### Annual Cost Estimates for Compensated Cirrhosis Due to MASH

- There is considerable variation in the health state costs among model publications **(Table 1)**
- Estimated costs in US cost-effectiveness analyses (CEAs) are derived from older datasets; while accounting for inflation, they do not account for other factors in rising healthcare costs. Costs only capture compensated cirrhosis state-specific costs, and do not include downstream costs from any subsequent states that would contribute to total cost of care
- Indirect costs are derived from UK productivity costs; other costs, caregiver, disability allowances, and transportation are not included in the table

**Table 1: Annual cost estimates for compensated cirrhosis due to MASH**

| Publication | Country | Annual Health State Cost (year) | 2026 Cost (CPI Inflation) | Derivation of Annual Costs Estimates | Source Publication |
|---|---|---|---|---|---|
| **CEA Models** | | | | | |
| Le et al. (2025) | US | **$21,836 (2025)** | **$22,720** | Model references a state-transition annual cost model for MASH patients, which obtained costs from US Veteran's Affairs datasets from 2008-2010 | Younossi et al. (2019) |
| Rustgi et al. (2022) | US | **$19,035 (2022)** | **$21,788** | Model references compensated cirrhosis due to MASH annual costs from 2017 to 2020, using a population of MASLD patients without chronic kidney disease | Rustgi et al. (2020) |
| Javanbakht et al. (2022) | US | **$20,012 (2022)** | **$22,906** | Model costs reference a 2016 model using micro-costing of overall healthcare costs for compensated cirrhosis due to MASH based on hepatologist consensus | Younossi et al. (2019) |
| **RWE** | | | | | |
| Kim et al. (2024) | US | **$57,705 (2024)** | **$63,042** | Annual all-cause post-index cost in Medicare insured patients with MASH and compensated cirrhosis | N/A |
| Wong et al. (2021) | US | **$35,715 (2021)** | **$45,736** | Adjusted annual all-cause post-index cost in commercially insured patients with MAFLD or MASH and compensated cirrhosis | N/A |
| **Indirect Costs** | | | | | |
| Morgan et al. (2021) | UK | **£5,363 (2018)** | **£7,298** | Annual indirect economic costs measured as productivity costs of compensated cirrhosis due to MASH patients in 2018 | N/A |

### Humanistic Outcomes

- Humanistic data were sparse and focused on generic and liver-specific QOL instruments; no studies comprehensively evaluated disability, activities of daily living, or the psychological and social burden associated with compensated cirrhosis due to MASH
- One study reported SF-36 findings, and two studies reported MASH specific burden scores using CLQD-MASH
- Patients demonstrated some symptomatic impairment (CLDQ-MASH 5.06-5.08 out of 7) and impairment to general health and vitality through SF-36; health utility scores were 0.675, vs. normal healthy individuals (0.85)

**PROs for Compensated Cirrhosis due to MASH**

| | | | |
|---|---|---|---|
| **SF-36 Findings:** USA | **General Health 52.2 (mean) Out of 100** | **CLDQ-MASH Findings:** GLOBAL | **5.06-5.08 Out of 7** |
| | **Vitality 54.8 (mean) Out of 100** | | |

## Discussion

- **Economic evidence in compensated cirrhosis due to MASH is methodologically and numerically heterogeneous**, driven by a lack of available literature and data within the field. Consequently, data are insufficient to isolate precise MASH-attributable HCRU and costs
- Multiple studies document **increasing costs from compensated cirrhosis to decompensated cirrhosis**, highlighting the economic risks of progression; where captured, **indirect costs demonstrated notable additional burden**
- **Humanistic evidence is sparse**, without consistent use of measures that can characterize functional, psychological, and social impacts

## Limitations

- Evidence base comprised of heterogeneous measures and outcomes of economic and healthcare burden
- Studies were predominately retrospective or claims based
- Conference abstracts and posters were included in the SLR search
- Search limits were set to English language only documents within only two databases (PubMed and Embase)

## Conclusion

**Costs of progression to advanced liver disease, including decompensated cirrhosis, are substantial** ($181,036 per patient per year, per a 2024 US Medicare analysis), **as are indirect costs due to fatigue leading to work productivity losses**; additional robust, multi-country, MASH-specific economic and humanistic studies are needed to fully understand patient burden and cost impact in compensated cirrhosis

### Abbreviations

CEA, cost-effectiveness analysis; CLDQ-MASH, Chronic Liver Disease Questionnaire–metabolic dysfunction-associated steatohepatitis; CPI, consumer price index; EQ-5D, EuroQol 5-Dimension; HCRU, healthcare resource use; HRQoL, health-related quality of life; HSU, health state utility; ICER, incremental cost-effectiveness ratio; LOS, length of stay; MAFLD, metabolic dysfunction-associated fatty liver disease; MASH, metabolic dysfunction-associated steatohepatitis; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PRO, patient-reported outcome; QALY, quality-adjusted life year; QoL, quality of life; RWE, real-world evidence; SF-36, 36-Item Short Form Health Survey; SLR, systematic literature review; Ti/Ab, title/abstract; UK, United Kingdom; US, United States; USD, United States dollars; vs., versus; WPAI:SHP, Work Productivity and Activity Impairment Questionnaire: Specific Health Problem.

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**SLR REFERENCES**

### Disclosures

**YK, NA, and KP** are employees and shareholders of Madrigal Pharmaceuticals, Inc. **LG, AD,** and **NH** are employees of Trinity Life Sciences, LLC, and have provided consulting services to Madrigal Pharmaceuticals, Inc., through their employment with Trinity. Trinity received funding from Madrigal Pharmaceuticals, Inc., for this study.

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