Economic Burden and Healthcare Resource Utilization of Metabolic Dysfunction-Associated Steatohepatitis (MASH) in Germany: A Claims Data Analysis

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OBJECTIVES

- Metabolic dysfunction-associated steatohepatitis represents a significant health concern that imposes a considerable economic burden on healthcare systems. (1,2)
- Given the rising prevalence of MASH in Germany (2), it is crucial to understand the burden and associated healthcare resource utilization (HCRU) and costs.
- The aim of this study was to generate insights regarding the economic burden of MASH in Germany.

METHODS

- A retrospective data analysis was performed using statutory health insurance claims data from 2017 to 2023 of the InGef research database.
- Patients were identified by ICD-10-GM diagnosis code K75.8 (MASH) in 2018 to 2022, by requiring ≥1 diagnosis during an inpatient encounter or ≥2 diagnoses codes in the outpatient setting.
- The first observable MASH diagnosis marked the index quarter.
- Exclusion diagnoses (other liver-related diseases), presence of end-stage liver disease (ESLD) and comorbid conditions were considered in a 1-year baseline period prior to the index quarter.
- ESLD disease states, ordered from least to most severe, included:
  - *Compensated cirrhosis (CC)*
  - *Decompensated cirrhosis (DCC)*
  - *Hepatocellular Carcinoma (HCC)*
  - *Liver transplant (LT)*
- Outcomes were analyzed in the follow-up period (at least 1-year), including the MASH index quarter and all subsequent quarters within the study timeframe.
- Costs and HCRU related to MASH were assessed for patients with progression (P) (any ESLD stage) and without progression (NP) during follow-up.

Adjusted analyses:

- Patients with ESLD at baseline who progressed to a higher ESLD stage during follow-up were classified as having disease progression in the adjusted analyses.
- Time to progression was measured from MASH index diagnosis to the first progression or to a higher ESLD stage in the follow-up.
- Cost regression analyses were performed using generalized linear models (GLM) with log link and gamma distribution, adjusting for baseline ESLD stages. Predictor variables included age, sex, disease states (non-progressing, CC, DCC, HCC, and LT; comorbidities at baseline (T2D, CVD, and obesity).
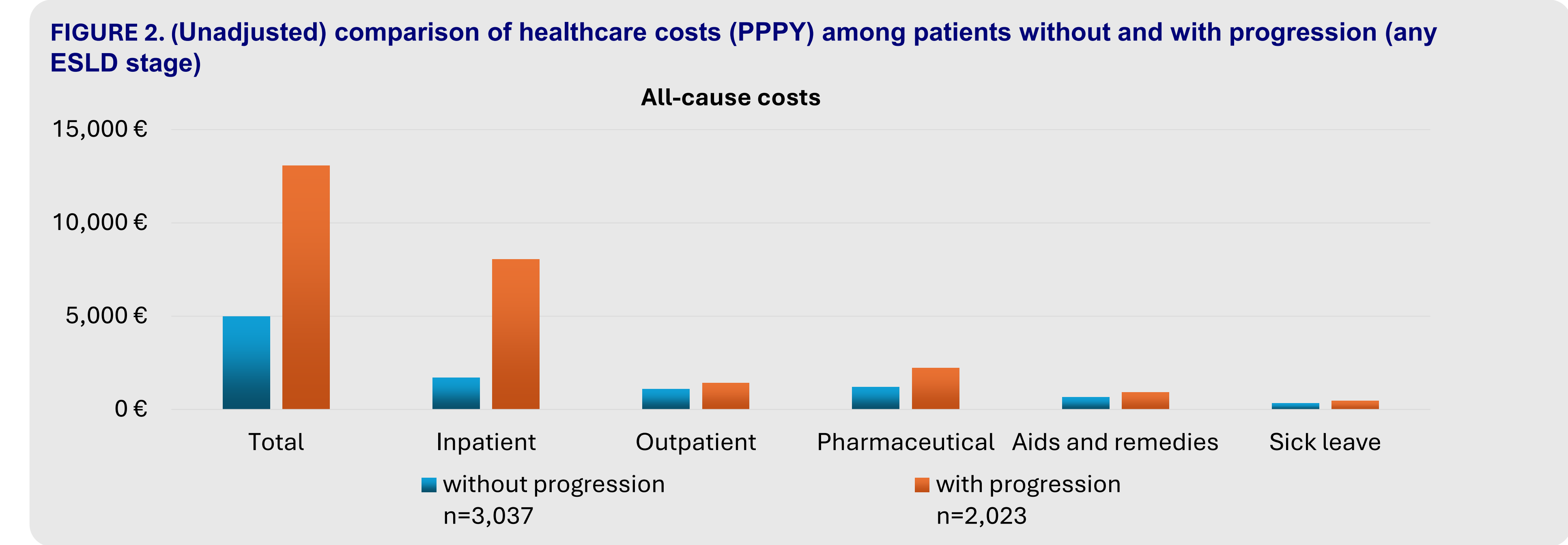
FIGURE 1. Study design
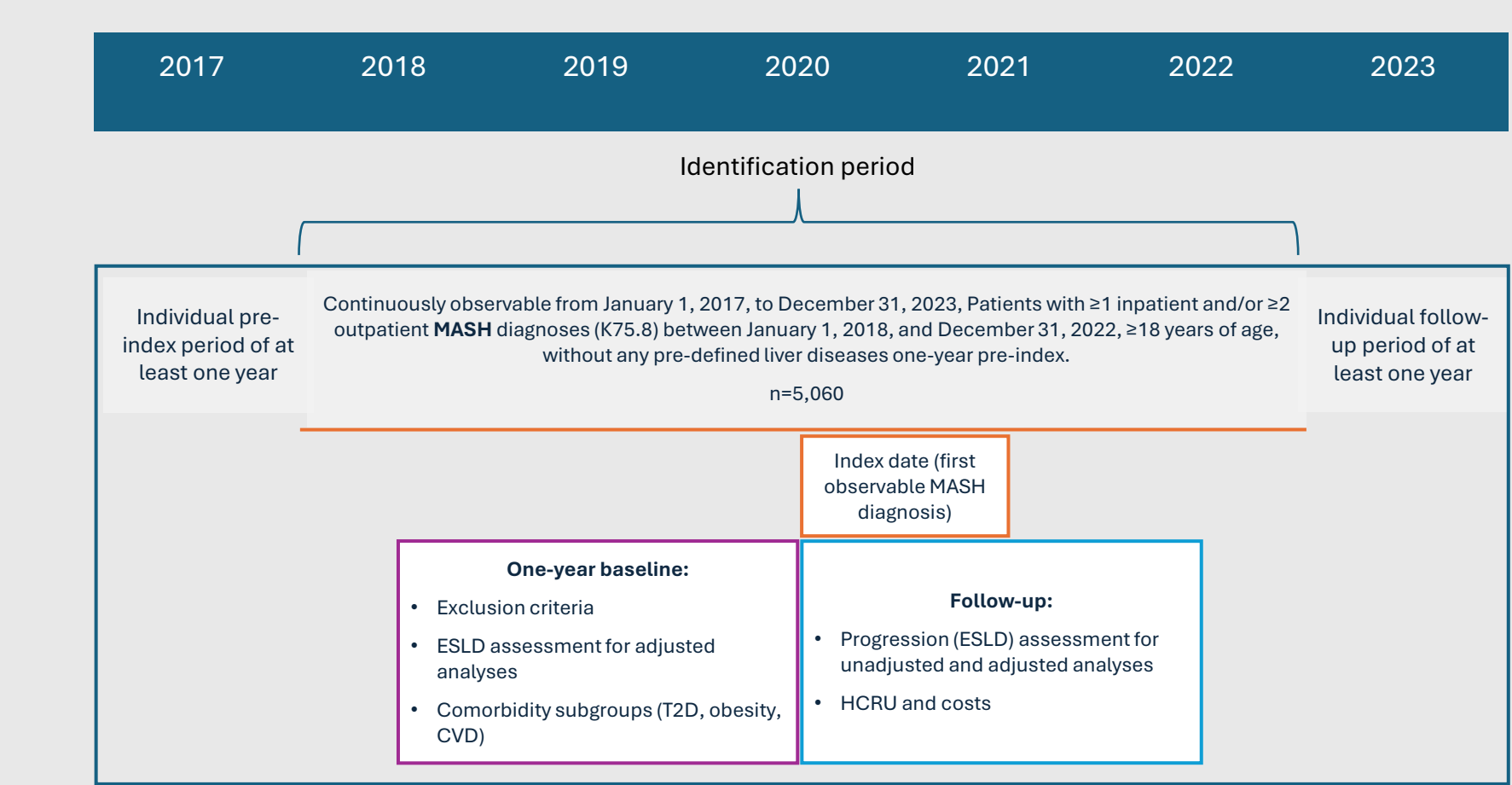
RESULTS

- A total of 5,060 patients with MASH were identified.
- Among these, 1,099 (21.7%) patients presented with ESLD at baseline.
- A total of 2,023 (40.0%) presented with progression (P-cohort, any ESLD stage), without adjusting for baseline ESLD stages or regression in the follow-up.
- Progressed patients had a higher median age (60.2 vs. 56.3 years for non-progressed).
- Male patients made up over 50% of both cohorts, with a slightly higher proportion in the non-progressed group (53.1% vs. 50.9%).
- In the main MASH cohort (n=5,060), most patients had CVD (70%), followed by obesity (37%) and T2D

RESULTS

FIGURE 2. (Unadjusted) comparison of healthcare costs (PPPY) among patients without and with progression (any ESLD stage)

- The average unadjusted cost per patient per year (PPPY) for the P-cohort was €13,071 compared to €4,982 in the NP-cohort (Figure 2).
- MASH/ESLD-related unadjusted cost PPPY were also higher for progressed patients with €2,286 compared to €401 in the NP-cohort (only referring to inpatient, outpatient, and sick leave costs).

- After adjusting for baseline ESLD stages and regression in the follow-up, a total of n=1,160 MASH patients (n=52 with ESLD baseline and n=1,108 without ESLD baseline) progressed (to a higher ESLD stage) in the follow-up (Figure 3).
- MASH patients with ESLD baseline progressed to a more severe ESLD stage within 18.5 months on average, those without ESLD within 21.0 months on average (Figure 3).

FIGURE 3. (Adjusted) time to progression (ESLD) (in months)
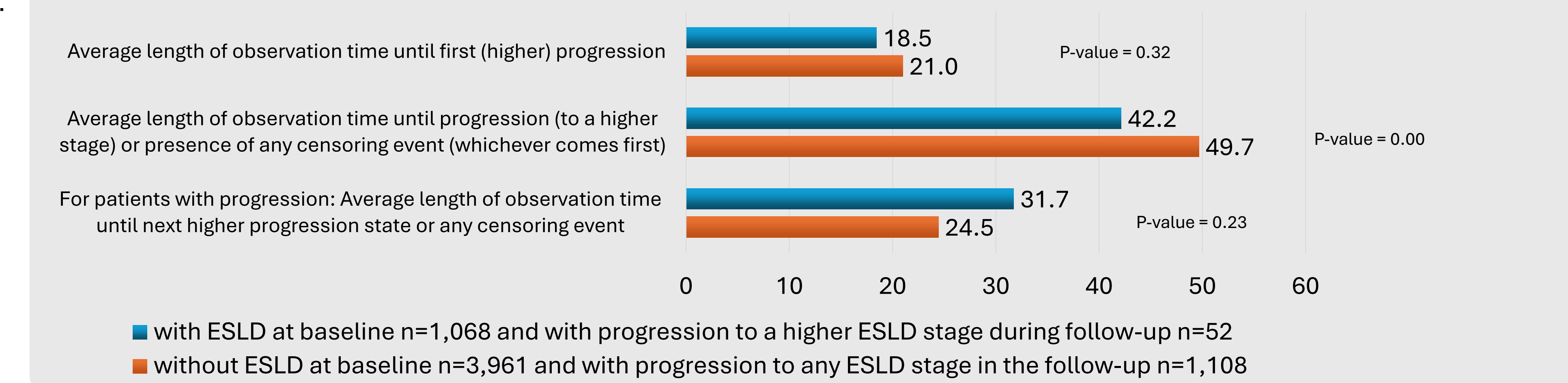
- GLM analysis of all-cause costs (PPPY) in the adjusted MASH cohort (n=5,029) showed predicted costs of €8,250 (95% CI: €6,740–€10,098) for progression to DCC and €14,467 (95% CI: €6,897–€30,343) for progression to HCC (Table 1).
- Among patients with progression (n=1,160), those progressing to HCC had significantly higher predicted costs (€20,052, 95% CI: €9,758–€41,204) compared to CC (reference) (Table 2).

- Patients with progression to HCC had 2.24 times higher costs (cost ratio: 2.24, 95% CI: 1.05–5.15).
- Statistically significant predictors of all-cause costs PPPY included HCC (2.24), T2D (1.57, 95% CI: 1.17–2.12), and age (1.02, 95% CI: 1.01–1.03) (Table 2).
- Progression to LT had the highest parameter estimate (9.32) but was not statistically significant (p = 0.08) (Table 2).

TABLE 1. Regression analysis of all-cause healthcare costs (PPPY) among the (adjusted) MASH cohort (n=5,029)

Independent Variable		Pr > t	Parameter estimate (exp)	95% CI Lower Limit (exp)	95% CI Upper Limit (exp)	Predicted costs†	95% CI Lower Limit	95% CI Upper Limit
Intercept		0.00	€ 1,723.60	€ 1,294.48	€ 2,309.65			
Age		0.00	1.01*	1.01	1.02			
Gender (reference: female)	male	0.44	0.95	0.83	1.08			
Disease state (reference: non-progressing)	CC	0.05	1.67	1.03	2.94	€ 6,617	€ 3,885	€11,272
	DCC	0.00	2.08*	1.76	2.47	€ 8,250	€ 6,740	€10,098
	HCC	0.00	3.65*	1.90	8.30	€ 14,467	€ 6,897	€ 30,343
	LT	0.06	14.45	2.15	1,709.71	€ 57,258	€ 3,632	€ 902,643
Comorbidities at baseline	T2D	0.00	1.44*	1.23	1.69			
	CVD	0.00	1.41*	1.18	1.67			
	Obesity	0.03	1.18	1.01	1.37			

† assuming the average age of the patients, and reference values for gender and comorbidities. The intercept refers to the baseline value of the outcome (in this case, costs) when all predictors in the model are set to zero.
Significant values are indicated by * (P < 0.05).

TABLE 2. Regression analysis of all-cause healthcare costs (PPPY) among (adjusted) MASH patients with progression (n=1,160)

Independent Variable		Pr > t	Parameter estimate (exp)	95% CI Lower Limit (exp)	95% CI Upper Limit (exp)	Predicted costs†	95% CI lower Limit	95% Ci Upper Limit
Intercept		0.00	2,429.31	1,222.36	5,030.21			
Age		0.00	1.02*	1.01	1.03			
Gender (reference: female)	male	0.74	0.96	0.75	1.23			
Disease state (reference: CC)	DCC	0.40	1.23	0.74	1.93	€ 10,975	€ 8,133	€14,811
	HCC	0.04	2.24*	1.05	5.15	€ 20,052	€ 9,758	€41,204
	LT	0.08	9.32	1.47	496.03	€ 83,260	€7,031	€ 985,918
Comorbidities at baseline	T2D	0.00	1.57*	1.17	2.12			
	CVD	0.84	1.04	0.73	1.46			
	Obesity	0.50	0.91	0.67	1.23			

† assuming the average age of the patients, and reference values for gender and comorbidities. The intercept refers to the baseline value of the outcome (in this case, costs) when all predictors in the model are set to zero.
Significant values are indicated by * (P < 0.05)

CONCLUSION

- On average, progression to a (more) severe ESLD stage was shown to occur within 18–21 months. This suggests that patients are often diagnosed at later disease stages and may be managed sub-optimally, contributing to faster disease progression.
- The findings of this study highlight the significant economic burden associated with MASH in Germany, as patients progressing to ESLD incur substantially higher costs per patient per year.
- Targeted interventions, including treatments that slow or halt disease progression, are urgently needed to mitigate the impact on patients and reduce the economic and utilization burden on the healthcare system.

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