PHARMACY SYSTEMS OUTCOMES AND POLICY COLLEGE OF PHARMACY

Healthcare Resource Utilization and Associated Medical Spending among Patients with Transthyretin Amyloid Cardiomyopathy (ATTR-CM) in the United States

EE306

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INTRODUCTION

- Transthyretin Amyloid Cardiomyopathy (ATTR-CM) is associated with amyloid fibrils deposits in the myocardium, leading to a restrictive cardiomyopathy, heart failure, arrhythmias, and death.[1]
- The first-in-class medication, tafamidis, was approved for the treatment of ATTR-CM in U.S. in 2019. Tafamidis, a transthyretin stabilizer, is effective, but highly expensive with the annul list price of $267,987.[2]
- After the introduction of disease-specific therapies, little research has explored the impact of this disease on health care spending. Given the paucity of data, it is important to quantify the health care resource utilization and the costs of healthcare for patients with ATTR-CM.

OBJECTIVE

- The primary aim of this study was to estimate all-cause, cardiovascular (CV)-related, and neuropathy-related healthcare resource utilization (HCRU) and healthcare spending among patients with ATTR-CM patients who are treated with tafamidis.
- We aimed to project the quarterly longitudinal changes in overall medical spending, inpatient spending, outpatient spending, and pharmacy spending over the follow-up period.
- Lastly, we examined the effect of key covariates, sex and age group, on the cost estimates.

METHOD

- **Study Design and Data Sources**: We conducted a retrospective observational research using Merative Health MarketScan Commercial Claims and Medicare Supplemental data.
- **Population:** A cohort of patient newly initiating tafamidis between 2019 - 2021 was followed until their disenrollment or more than 1-month gap in enrollment. A 3-month washout period was applied to assess key characteristics, prior medication use, and pre-existing comorbidities.
- **Outcome**
  - **Medical Spending**: Annual expenditures per patient were measured as total sum of payer spending, and out-of-pocket payments, and separately out-of-pocket payments. Total medical spending included inpatient, outpatient, and pharmacy spending for tafamidis dispensing with separate estimates of each item. CV-related and neuropathy-related spending was estimated when the associated ICD codes appeared as the primary diagnosis. Additionally, inpatient spending per admission was measured.
  - **HCRU**: Annual frequency of hospitalization and emergency department (ED) visits were estimated per patient. Average length of inpatient stays was measured per admission. CV-related, and neuropathy-related HCRU were estimated when the relevant ICD-codes appeared as a primary diagnosis.
  - **CV-related events** included cardiac arrhythmias, cardiomyopathy, heart failure, and stroke. **Neuropathy events** included neuropathy, mononeuropathy, polyneuropathy, and carpal tunnel syndrome.
- **Data Analysis**
  - Mean and standard deviations were examined. All results were summarized into yearly periods to calculate the annual HCRU and medical spending. Additionally, length of stay and inpatient costs were estimated on a per-hospitalization basis.
- **Statistical Methods**
  - Regression analyses using a generalized linear model (GLM) with a log-link function and tweedie family and two parts model were performed.

REFERENCES

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Table 1. Annual Medical Spending on Patients with Tafamidis

	Total Spending† ($), Mean (SD)	OOP‡ Spending($), Mean (SD)
All-cause		
Total Medical Spending*, PPPY	$295,434.02 (240,180.76)	$4,314.95 (9,264.00)
Inpatient Spending, PPPY	$25,727.23 (108,615.29)	$281.02 (1,241.45)
Outpatient Spending, PPPY	$45,438.34 (170,342.69)	$1,030.28 (1,705.01)
Pharmacy (Tafamidis) Spending, PPPY	$224,268.44 (107,664.19)	$3,003.64 (8,900.63)
CV-related		
Total Medical Spending*, PPPY	$20,299.79 (66,353.20)	$387.73 (1243.42)
Inpatient Spending, PPPY	$10,132.61 (51,164.98)	$152.23 (974.09)
Outpatient Spending, PPPY	$10,167.17 (40,673.91)	$235.49 (712.10)
Neuropathy-related		
Total Medical Spending*, PPPY	$13,294.59 (105,690.92)	$23.60 (188.67)
Outpatient Spending, PPPY	$13,294.59 (105,690.92)	$23.60 (188.67)

Abbreviations: CV, Cardiovascular; OOP, Out-of-Pocket; PPPY, Per Patient Per Year
† Total spending included payer's payment and out-of-pocket payment.
‡ Out-of-pocket payment was a sum of coinsurance, copayment, and deductible.
* Total medical spending included inpatient, outpatient, and pharmacy spending for all-cause events, and included inpatient and outpatient spending for CV. Encounters with neuropathy in a primary diagnosis position were not identified.

Table 2. Annual Healthcare Resource Utilization on Patients with Tafamidis

	Frequency/Length of Stay, Mean (SD)
All-cause	
Number of Inpatient Admissions, PPPY	0.6898 (1.6338)
Number of ED Visits, PPPY	0.6988 (2.1638)
Cardiovascular-related	
Number of Inpatient Admissions, PPPY	0.2717 (0.9613)
Number of ED Visits, PPPY	0.0688 (0.5077)

Abbreviations: ED, Emergency Department; PPPY, Per Patient Per Year

Table 3. Healthcare Resource Utilization and Medical Spending on Patients with Tafamidis, per admission

	All-cause, Mean (SD)	CV-related, Mean (SD)
Medical Spending		
Total Inpatient Spending, per admission	$33,930.14 (59,506.22)	$33,898.95 (60739.17)
OOP Inpatient Spending, per admission	$451.39 (854.45)	$486.75 (988.72)
Healthcare Resource Utilization		
Mean Length of Hospital stay, per admission	6.48 days (6.64)	6.69 days (6.92)

Abbreviations: CV, Cardiovascular; OOP, Out-of-Pocket

CONCLUSION

Substantial HCRU and medical spending , largely driven by tafamidis costs, were incurred among newly initiated tafamidis users. Further research is warranted to evaluate the HCRU and healthcare spending patterns among patients with ATTR-CM.

CONTACT INFORMATION

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Figure 1. Quarterly Spending Projection over the Follow-up Period

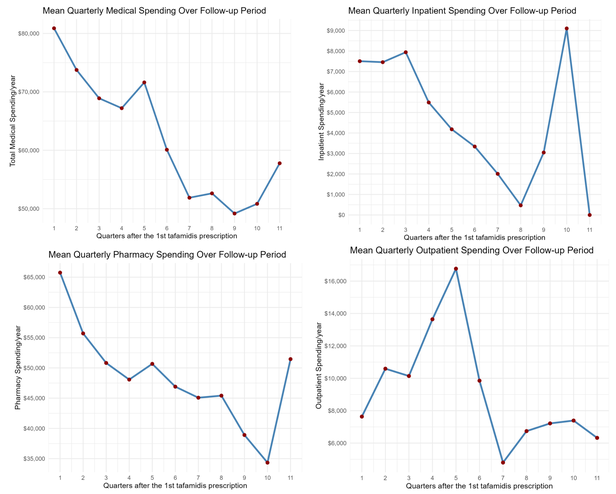

Table 4. Marginal Effects of Key Covariates on Annual Healthcare Spending

Covariates	GLM with log-link function and twiddie family, marginal effects (p-val)	Two parts model, marginal effects (p-val*)
Model 1:		
Male	- $1,342 (0.960)	- $18,284 (0.996)
Age ≥ 75	- $40,451 (0.067)	- $40,489 (0.070)
Model 2:		
Male	- $11,150 (0.679)	- $27,445 (0.997)
Age ≥ 75	- $44,381 (0.045)**	- $43,426 (0.051)**
Model 3:		
Male	$185 (0.994)	- $12,803 (0.999)
Age ≥ 75	- $54,084 (0.009)**	- $42,518 (0.994)

Abbreviations. GLM, generalized linear mode
Note: Model 1 regressed on sex, age group, model 2 regressed on sex, age group, and comorbidities, and model 3 regressed on sex, age group, comorbidities, and medications
* P-value of the 2nd part of two-part model, GLM with log-link function and gamma family, was reported.
** Statistically significant at the 5% significance level (α = 0.05)

Table 5. Baseline Characteristics of Tafamidis Patients

Characteristic	N = 346*
Age (years)	75 (11)
Age Group	
< 64	64 (18%)
65-74	61 (18%)
≥ 75	221 (64%)
Gender	
Male	273 (79%)
Female	73 (21%)
Geographic Region	
Northeast	143 (41%)
Northcentral	108 (31%)
South	78 (23%)
West	17 (4.9%)
Unknown	0 (0%)
Medicare	
Medicare	282 (82%)
Comorbidities	
Acute Myocardial Infarction	27 (7.8%)
Chronic Heart Failure	297 (86%)
Peripheral Vascular Disorders	80 (23%)
Dementia	37 (11%)
COPD	37 (11%)
Rheumatic Disease	6 (1.7%)
Liver disease, mild	10 (2.9%)
Diabetes, no complication	39 (11%)
Renal disease, mild	95 (27%)
Diabetes, complication	18 (5.2%)
Malignancy	39 (11%)
Renal disease, severe	10 (2.9%)
Medications	
ACEIs	61 (18%)
ARBs	108 (31%)
BBs	227 (66%)
Non-dihydropyridines	14 (4.0%)
Spironolactone	106 (31%)
Statin	215 (62%)

*Mean (SD); n (%)
Abbreviations. ACEIs, angiotensin converting enzyme inhibitors; AIDS, acquired immunodeficiency syndrome; ARBs, angiotensin receptor blockers; BBs, beta blockers; COPD, chronic obstructive pulmonary disease; HIV, human immunodeficiency virus;

RESULTS AND DISCUSSION

- The cohort consisted of 346 patients who initiated tafamidis; in the cohort, 79% were male, 64% were over 75 years-of-age, 86% had baseline congestive heart failure, and 66% took beta blockers at baseline.
- **Medical Spending:** Annual all-cause total healthcare spending was $295,434 (95CI: $274,742-$316,126), and annual all-cause out-of-pocket payment was $4,315 ($3,517-$5,113) per patient, which is 1.4% of the total spending. Tafamidis spending accounted for 76% of total medical spending. CV-related spending, and neuropathy-related spending accounted for approximately 6.9%, 3.4% of total medical spending respectively (Table 1).
- **HCRU:** On average, patients receiving tafamidis experienced 1 hospitalization every 17 months, and patients were admitted every 44 months for CV-related events. Each admission was associated with prolonged LOS, 6.48 days (5.92-7.04 days) and 6.69 days (5.82-7.56 days) respectively (Table 2 and Table 3). Patients visited emergency department every 17 months for all-cause, and 174 months for CV-related cause on average (Table 2).
- Overall, quarterly healthcare spending peaked following the tafamidis prescription and gradually declined over the follow-up period. Pharmacy spending primarily drove the overall trend in healthcare spending.

LIMITATIONS

- Mortality was not accounted for in the analysis. This limitation may raise a concern regarding potential overestimation of HCRU and medical spending, as end-of-life HCRU tend to be substantial.
- Our cohort was limited to a subset of ATTR-CM patients who received tafamidis as a validated mechanism to identify ATTR-CM was not available. Therefore, the findings may not be generalized to the general ATTR-TM patients, particularly who did not receive tafamidis.

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