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Patterns of Total Cost of Care by Age Group for Patients With Newly Diagnosed Multiple Myeloma (MM)

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INTRODUCTION

- Evidence from large randomized clinical trials has mounted in support of the use of advanced therapies (Tx), such as lenalidomide (LEN) and bortezomib (BORT), as well as for longer treatment for patients (pts) with newly diagnosed MM (NDMM)
- Longer treatment durations for pts with NDMM further raises economic questions, regarding:
  - The economic impact of extending time to progression (TTP)
  - The cost consequences when pts relapse and move to a second line of Tx
- Previous analyses showed that pts with MM incurred higher monthly costs upon advancing to later lines of Tx.[1,2] However, few studies have examined the real-world cost patterns of NDMM pts by age group before and after their first relapse
- Assessing the cost patterns of these agents will be valuable in informing decisions on the cost-effectiveness and economic benefits of these Tx, given the constrained resources and budget for healthcare

OBJECTIVE

- To evaluate patterns of total costs of care, from Tx initiation until progression, for pts with NDMM and pts with newly relapsed disease by age group, across Tx, using time to next therapy (TTNT) as a proxy measure for progression

METHODS

Data Source and Study Design

- A retrospective analysis was conducted using a large US database containing medical and pharmacy claims for healthcare services as well as enrollment information, with data sourced from employer-sponsored health insurance plans and Medicare/Medicaid, covering > 25 million lives annually
- Claim files included service dates, provider reimbursement amounts, pt copayment, deductible amounts, and enrollment data
- This analysis evaluated pts with NDMM and relapsed MM, aged < 75 years and ≥ 75 years, who received LEN- or BORT-based Tx and had a complete claim history from onset to initiation of subsequent Tx for the period between January 2006 and December 2013

Patient Selection

- Participants were identified with at least 2 ambulatory claims or 1 inpatient claim associated with a diagnosis of MM (ICD-9-CM] code 203.0X)
- Index date refers to the date of the first claim with an MM diagnosis code in the specified study period

METHODS (cont)

- Inclusion criteria were:
  - ≥ 12 months enrollment before index date
  - ≥ 6 months enrollment after index date
  - ≥ 6 months post first treatment continuous enrollment in the defined study period
- Pts with claims for stem cell transplant (SCT) were excluded, to avoid confounding results from various factors based on timing, costs, and site of care of SCT
- Pts with BORT + LEN combined therapy (with ≥ 30 days overlap) were also excluded

Measures and Data Analyses

- The following definitions for treatment episodes were used in the study:
  - **First-line treatment:** The first LEN- or BORT-based treatment that a pt with NDMM received after index date. This excluded SCT + maintenance Tx or other Tx (≥ 60 days treatment other than BORT, LEN)
  - **Second-line treatment:** The second regimen that a pt received following a first-line LEN- or BORT-based treatment
  - **TTNT**, defined as the time from the start of a line of Tx to the subsequent line of Tx, was used as a proxy measure for progression (ie, TTP)
- Pts receiving the above treatments were followed up until TTNT
- Healthcare utilization was assessed by component of care, **medical** (ie, inpatient, ambulatory, emergency room costs) and **pharmacy** (ie, index and other prescription drug costs)
- Direct costs were taken as the sum of medical and pharmacy-related costs; reported in 2014 US dollars
- Average monthly costs were calculated using methods similar to those described by Gaultney et al.[1] Quarterly cost patterns for each line of Tx were also determined
- For each treatment, monthly costs were cumulated up to the median TTNT, as calculated via a Kaplan-Meier analysis, and divided by the median number of months of TTNT, to determine the average
- Average Charlson Comorbidity Index (CCI) scores were determined to compare baseline measures between groups

RESULTS

Patient Characteristics

- 2843 pts with NDMM (1862 pts aged < 75 yrs; 981 ≥ 75 yrs) and 1361 pts with MM receiving second-line Tx (978 pts aged < 75 yrs; 383 pts ≥ 75 yrs) were identified
- Baseline characteristics are summarized in **Table 1**
- Baseline comorbidities were higher in the ≥ 75-yr age group than the < 75-yr age group; however, they were similar between treatment groups of the same age category. This resulted in higher CCI scores for those ≥ 75 yrs, but similar scores within treatment groups

RESULTS (cont)

Table 1. Patient Baseline Characteristics

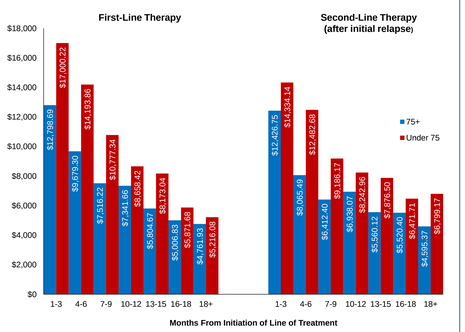
Age Group	< 75 yrs			≥ 75 yrs		
Treatment	**Both (n = 2840)**	**LEN-Based (n = 1447)**	**BORT-Based (n = 1393)**	**Both (n = 1364)**	**LEN-Based (n = 666)**	**BORT-Based (n = 698)**
Sex, n (%)						
First-line Tx						
Male	1057 (56.8)	473 (56.7)	584 (56.8)	577 (58.8)	266 (59.5)	311 (58.2)
Female	805 (43.2)	361 (43.3)	444 (43.2)	404 (41.2)	181 (40.5)	223 (41.8)
Second-line Tx						
Male	525 (53.7)	326 (53.2)	199 (54.5)	223 (58.2)	132 (60.3)	91 (55.5)
Female	453 (46.3)	287 (46.8)	166 (45.5)	160 (41.8)	87 (39.7)	73 (44.5)
Mean Age at First MM Claim (yrs)						
First-line Tx	62.5	62.2	62.3	80.4	80.4	80.5
Second-line Tx	61.9	61.6	62.3	79.8	79.9	79.8
CCI score, mean						
First-line Tx	2.10	1.99	2.20	2.75	2.66	2.82
Second-line Tx	1.97	1.87	2.15	2.66	2.52	2.84

BORT, bortezomib; CCI, Charlson Comorbidity Index ; LEN, lenalidomide; MM, multiple myeloma; Tx, therapy.

- TTNT for NDMM pts were 28.1, 24.7, and 33.6 months for the overall, age < 75 yrs, and age ≥ 75 yrs populations, and TTNT was longer for pts initiated on LEN-based regimens compared with BORT

Cost of MM Over the Course of Treatment

Figure 1. Monthly Direct Costs (Medical + Pharmacy) During Course of Disease

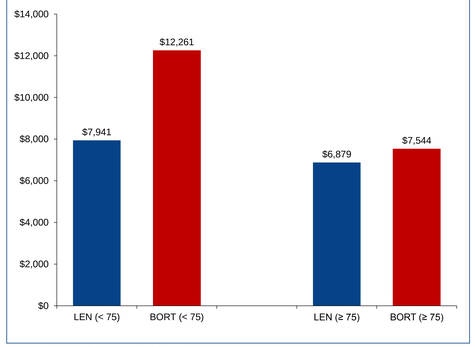


- Monthly total direct costs for pts with NDMM exceeded $12,000 in the first 3 months of treatment, and declined each quarter, reaching approximately $5000/month at 18+ months after initiation of therapy. For second-line therapy, initial costs and patterns of quarterly decline were similar. **(Figure 1)**. Costs were lower in pts aged 75+ yrs; in pts with NDMM this gap moderated over time

RESULTS (cont)

Average Monthly MM Healthcare Costs by Age and Treatment

Figure 2. Monthly Direct Costs of Patients Initiated on LEN- or BORT-based Therapies; Average Over a Common Time Period



BORT, bortezomib; LEN, lenalidomide.

- Quarterly cost reduction patterns were consistent across Tx, lines of therapy, and age groups
- We compared cohorts of pts initiated on each Tx and followed costs for a common time period equal to the longer median TTNT of the two Tx (LEN): 35 mos for pts age <75 yrs and 39 mos for pts age ≥ 75 yrs
- Monthly costs averaged $7941 in the LEN cohort compared with $12,261 in the BORT cohort of pts aged < 75 years. For pts aged ≥ 75 yrs, monthly costs averaged $6879 in the LEN cohort vs $7544 in the BORT cohort **(Figure 2)**
- Cost differences in ordinal months were due to higher monthly medical costs for pts treated with BORT; average monthly drug costs were similar. Overall average and cumulative costs were higher with BORT due to earlier advancement to subsequent line of therapy and its associated higher initial cost
- CCI scores were similar across Tx

DISCUSSION

- This analysis is one of the first to document the economic impact associated with progression for pts with NDMM by age group, as evidenced by the increase in costs associated with beginning second-line therapy
- This increased monthly cost of therapy after progression, combined with the clinical consequences of progression, suggests an alignment between the economic and outcome benefits of extending time without progression for pts with NDMM

LIMITATIONS

- Claims data are subject to possible entry errors, coding for the purpose of rule-out rather than actual disease, and undercoding
- These data come from a commercially insured and managed Medicare/Medicaid population and may not be applicable to pts in non–managed care settings
- These results are generalizable only to the US healthcare system

CONCLUSIONS

- For a population of pts with NDMM receiving either LEN- or BORT-based Tx without SCT, total monthly drug and medical costs per pt declined steadily over time, decreasing by two-thirds over the TTNT period
- Costs returned to near-baseline levels when pts began second-line therapy, then declined similarly. This pattern of cost decline was consistent regardless of age, Tx, or line of therapy. This may suggest that further extending the TTP for pts with NDMM may yield more economic benefits for each month of extension before relapse
- Average monthly total costs over 3 years were lower for pts with NDMM initiated on LEN-based Tx, due to longer periods with below-average costs prior to the initiation of second-line therapy

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