

# US Cost Burden of Relapsed Refractory Multiple Myeloma During Third and Later Lines of Treatment

Poster No. 4725

Presenting author: Eugene.x.Felber@gsk.com

Gene Felber<sup>1</sup>, Chi-Chang Chen<sup>2</sup>, Jenny Willson<sup>3</sup>, Chris Bell<sup>4</sup>, Edgar Simard<sup>5</sup>, Sasikiran Nunna<sup>2</sup>, Chandrabhan Dharmani<sup>1</sup>, Heide Stirnadel-Farrant<sup>6</sup>, Feng Wang<sup>1</sup>, Amanda Bruno<sup>1</sup>

<sup>1</sup>GSK, Philadelphia, PA, USA; <sup>2</sup>IQVIA, Plymouth Meeting, PA, USA; <sup>3</sup>GSK, London, UK; <sup>4</sup>GSK, Research Triangle Park, NC, USA; <sup>5</sup>GSK, Upper Providence, PA, USA; <sup>6</sup>GSK, Stevenage, UK

## Aims

- Novel therapies for multiple myeloma (MM), typically applied in late-line relapsed refractory disease, have led to improvements in real-world disease control and patient survival.<sup>1-4</sup>
- The cost burden of late-line relapsed refractory MM is not completely understood due to the wide range of interventions and the presence of newly approved therapies, although previous studies have evaluated some of these factors.<sup>5,6</sup>
- This retrospective cohort analysis of US claims data examined total all-cause, MM-related, and MM-associated symptomatic event-related healthcare costs for patients with MM.

## Methods

### Design and data source

- This was a retrospective cohort study utilizing IQVIA Real World Data Adjudicated Claims database (IQVIA®, Durham, NC), a US commercial claims database containing enrollment data and data on medical/pharmacy health insurance claims.
- The index date was the date of first MM diagnosis.
- Costs were examined at different lines of treatment (LOTs), with a focus on patients at the third line (3L) or with four or more lines (4L+).

### Study population

- An incident population was identified using the following key inclusion criteria: ≥2 diagnoses of MM (International Classification of Diseases [ICD]-9 203.0x, ICD-10 C90.0x) ≥30 days apart during the study period (January 1, 2012 to December 31, 2016), ≥18 years of age at first MM diagnosis, received ≥1 MM therapy of interest post index, were enrolled for pharmacy and medical benefits ≥1 year prior to index, and ≥1 year of follow-up post index.
- Key exclusion criteria included an MM diagnosis or a treatment of interest during the year prior to indexing; an invalid year of birth, gender, or health plan enrollment dates; and ≥2 diagnoses for other lymphomas and/or leukemias ≥30 days apart during the study period.

### Endpoints and analyses

- Endpoints included all-cause and MM-related costs per patient per month (PPPM), occurrence of common MM-associated symptomatic events, MM-associated symptomatic event-related costs per episode, and proportion of patients requiring MM-associated symptomatic event-related hospitalization.
  - MM-related costs and healthcare resource utilization were measured using claims with a primary or secondary diagnosis of MM or pharmacy claims for MM-related oral or infused therapy.
- Descriptive analyses were conducted based on LOT (first line [1L], second line [2L], 3L and 4L+). The 1L was defined as first therapy used post index and comprised all MM drugs of interest observed within a window of 28 days after the first MM drug. A LOT end was identified as a 90-day gap in the therapy regimen or use of a new agent outside the 28-day window.
- All-cause and MM-related costs were compared between patients indexed from 2012–2014 and 2015–2017 (ranges based on the availability of new MM drugs) using a univariate generalized model with log link and gamma distribution. Additionally, a subgroup analysis of all-cause costs in patients with and without post-index stem cell transplantation was performed.

## Results

### Patients

- 2120 patients were included in the incident cohort.
  - Of these, 799 (37.7%) and 390 (18.4%) patients received 3L and 4L+ treatments, respectively.
  - Mean (standard deviation, SD) age at initial MM diagnosis, for patients progressing to 3L and 4L+, were 58.9 (8.9) and 58.8 (8.6) years, respectively.
  - More patients at 3L or 4L+ used recently approved agents (29.2% and 66.9%, respectively) versus patients at 1L (1.4%) and 2L (12.0%).
    - Recently approved therapies were carfilzomib, daratumumab, elotuzumab, ixazomib, panobinostat, and pomalidomide.

### All-cause and MM-related costs

- Mean (median) all-cause and MM-related total PPPM costs were higher in patients at 3L and 4L+ versus the mean (median) costs for the entire cohort (Table 1).
  - Several individual patients incurred very high costs that skewed mean values at 3L and 4L+.
  - In the full population, total mean (median) all-cause PPPM costs were greater for patients with post-index stem cell transplantation \$23,209 (\$21,032) versus those without \$15,620 (\$12,326). This appeared to be driven by higher inpatient PPPM costs for patients with versus without transplantation (\$6,644 [\$4,578] versus \$3,768 [\$810], respectively).
  - In the full population, total costs were greater in patients indexed later in calendar time (2015–2017) versus earlier (2012–2014) (inflation adjusted to 2017 dollars). Mean (median) all-cause PPPM costs were significantly greater among late-indexed \$21,240 (\$18,576) patients versus early-indexed patients \$18,749 (\$16,309) (mean and median: p<0.001); MM-related PPPM costs were \$16,626 (\$15,432) versus \$13,976 (\$13,013), respectively (mean and median: p<0.0001).

### MM-associated symptomatic events: frequency and cost

- The five most frequent MM-associated symptomatic events after initial MM diagnosis were mainly hematologic in nature: anemia, neutropenia, and thrombocytopenia, pneumonia, and bone pain (Figure 1).
  - The number of episodes ranged from approximately 1000 to 8000.
- The episode duration of the five most frequent MM-associated symptomatic events was short (median range: 1.0–5.0 days).
- The MM-associated symptomatic event-related median cost per episode for hematologic symptoms (except bone pain) was similar between the total cohort (\$700–\$4,500) and 3L (\$700–\$8,000) and increased at 4L+ (\$2,000–\$9,000, Figure 2).
  - Median costs were highest for 4L+ for anemia, neutropenia, and pneumonia.
- Increasing MM-associated symptomatic event-related costs from 3L to 4L+ appeared driven by increased inpatient and outpatient costs (Table 2).

**Table 1. All-cause and MM-related costs PPPM in patients throughout the follow-up period versus during 3L and 4L+ (incident cohort)**

	All (N=2120)*		3L (n=799)		4L+ (n=390)	
	Mean	Median	Mean	Median	Mean	Median
<b>All-cause costs PPPM</b>						
Total costs	\$19,762	\$17,286	\$88,509	\$18,952	\$39,592	\$22,037
Costs under the pharmacy benefit†	\$5,123	\$4,802	\$8,448	\$9,318	\$8,260	\$8,440
Costs under the medical benefit						
Hospitalization costs	\$7,023	\$4,316	\$118,015	\$7,920	\$33,368	\$5,900
Hospitalization costs (excluding costs above the 99th percentile)	\$6,207	\$4,229	\$27,307	\$7,556	\$12,611	\$5,787
ED costs	\$162	\$69	\$411	\$122	\$420	\$111
Outpatient costs	\$9,420	\$7,240	\$49,469	\$7,648	\$16,479	\$9,825
Outpatient costs (excluding costs above the 99th percentile)	\$8,941	\$7,107	\$27,803	\$7,371	\$13,047	\$9,659
<b>MM-related costs PPPM</b>						
Total costs	\$15,053	\$13,851	\$74,004	\$16,114	\$24,501	\$17,817
Costs under the pharmacy benefit†	\$4,682	\$4,417	\$8,462	\$9,597	\$8,394	\$8,416
Costs under the medical benefit						
Hospitalization costs	\$4,115	\$2,322	\$98,538	\$427	\$4,237	\$586
Hospitalization costs (excluding costs above the 99th percentile)	\$3,732	\$2,308	\$17,329	\$385	\$4,009	\$545
ED costs	\$117	\$42	\$454	\$99	\$226	\$60
Outpatient costs	\$7,794	\$6,054	\$47,979	\$6,423	\$15,518	\$8,009
Outpatient costs (excluding costs above the 99th percentile)	\$7,369	\$5,971	\$27,321	\$6,215	\$11,996	\$7,964

\*Data across all lines, patients may have received varying number of lines; †these costs could include MM treatment costs 3L, third line; 4L+, fourth and later lines; ED, emergency department; MM, multiple myeloma; PPPM, per patient per month

**Table 2. MM-associated symptomatic event-related costs per episode in all patients throughout the follow-up period versus during 3L and 4L+ (incident cohort)**

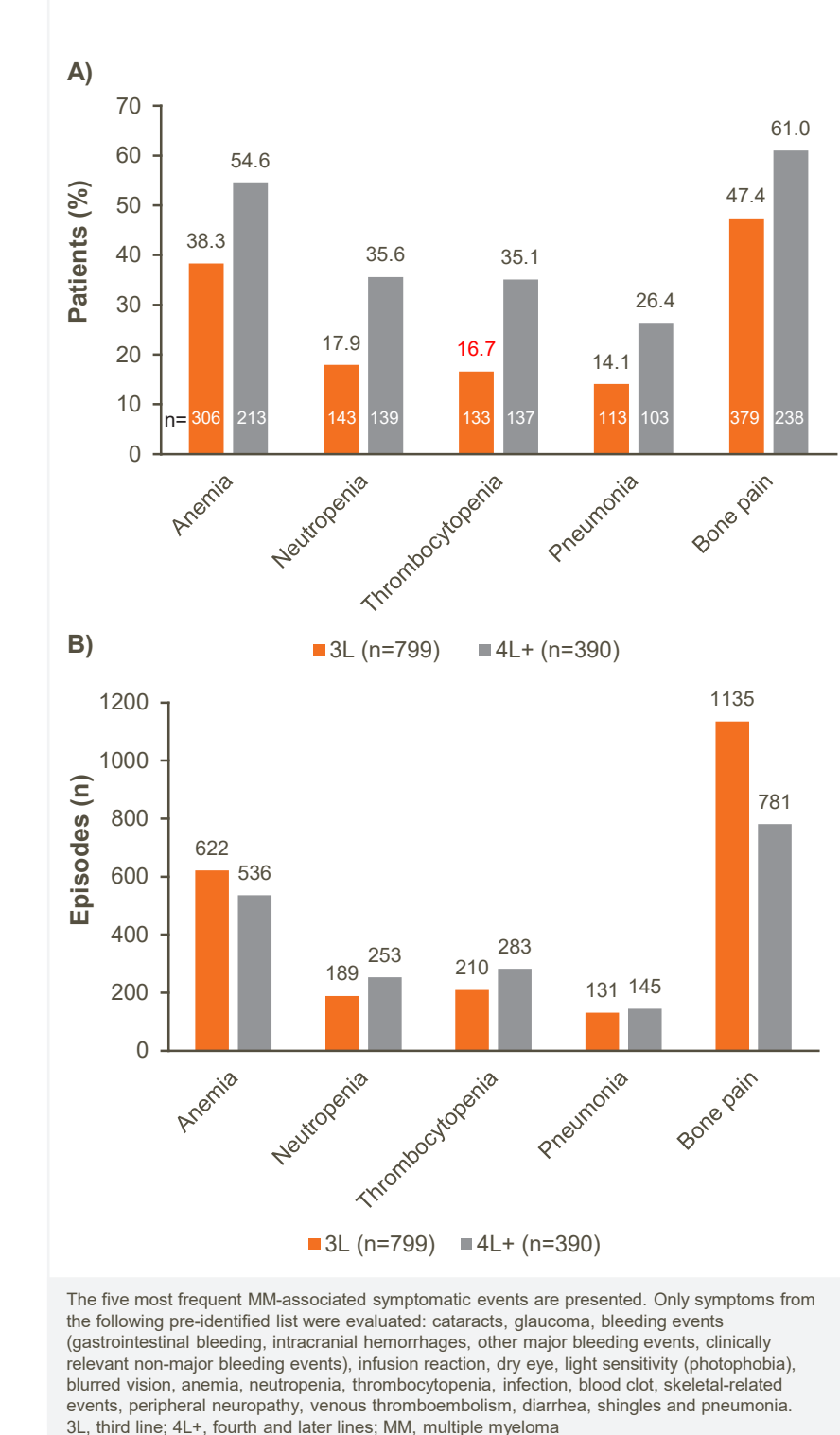
Total cost	All		3L		4L+	
	Mean	Median	Mean	Median	Mean	Median
<b>Anemia*</b>	N=5786		N=622		N=536	
Total costs	\$29,955	\$1,530	\$17,963	\$880	\$31,696	\$2,989
Costs under the pharmacy benefit†	\$17	\$0	\$29	\$0	\$45	\$40
Costs under the medical benefit						
Hospitalization costs	\$19,958	\$0	\$10,780	\$0	\$19,390	\$0
ED costs	\$82	\$0	\$69	\$0	\$152	\$0
Outpatient costs	\$9,897	\$320	\$7,084	\$423	\$12,109	\$447
<b>Neutropenia*</b>	N=1671		N=189		N=253	
Total costs	\$24,586	\$1,842	\$21,099	\$1,980	\$20,332	\$3,338
Costs under the pharmacy benefit†	\$95	\$0	\$93	\$0	\$153	\$0
Costs under the medical benefit						
Hospitalization costs	\$19,272	\$0	\$13,371	\$0	\$10,390	\$0
ED costs	\$22	\$0	\$19	\$0	\$27	\$0
Outpatient costs	\$5,197	\$189	\$7,617	\$451	\$9,762	\$260
<b>Thrombocytopenia*</b>	N=1782		N=210		N=283	
Total costs	\$17,940	\$1,151	\$10,283	\$706	\$14,465	\$1,740
Costs under the pharmacy benefit†	\$0	\$0	\$0	\$0	\$0	\$0
Costs under the medical benefit						
Hospitalization costs	\$13,119	\$0	\$6,316	\$0	\$7,630	\$0
ED costs	\$104	\$0	\$41	\$0	\$286	\$0
Outpatient costs	\$4,717	\$4,124	\$3,926	\$167	\$6,549	\$304
<b>Pneumonia*</b>	N=1139		N=131		N=145	
Total costs	\$21,998	\$4,556	\$18,284	\$7,967	\$24,112	\$9,300
Costs under the pharmacy benefit†	\$79	\$0	\$61	\$2	\$99	\$0
Costs under the medical benefit						
Hospitalization costs	\$20,446	\$602	\$17,080	\$697	\$19,857	\$6,622
ED costs	\$142	\$0	\$210	\$0	\$61	\$0
Outpatient costs	\$1,331	\$61	\$933	\$110	\$4,095	\$0
<b>Bone pain*</b>	N=7710		N=1135		N=781	
Total costs	\$2,979	\$711	\$1,593	\$456	\$2,334	\$354
Costs under the pharmacy benefit†	\$62	\$0	\$51	\$0	\$56	\$0
Costs under the medical benefit						
Hospitalization costs	\$446	\$0	\$27	\$0	\$586	\$0
ED costs	\$0	\$0	\$0	\$0	\$0	\$0
Outpatient costs	\$2,470	\$625	\$1,516	\$432	\$1,692	\$328

\*Percentage of patients with anemia-related hospitalizations and ED visits, respectively: All (31.6%, 5.2%), 3L (19.1%, 3.4%), 4L+ (28.8%, 5.2%); †costs of prescriptions related to specific MM-associated symptomatic event filled in pharmacy; ‡percentage of patients with neutropenia-related hospitalizations and ED visits, respectively: All (37.9%, 3.4%), 3L (28.6%, 2.6%), 4L+ (30.8%, 5.5%); §percentage of patients with thrombocytopenia-related hospitalizations and ED visits, respectively: All (36.8%, 5.2%), 3L (23.8%, 4.3%), 4L+ (29.7%, 7.1%); ¶percentage of patients with pneumonia-related hospitalizations and ED visits, respectively: All (59.3%, 16.5%), 3L (60.3%, 20.6%), 4L+ (65.5%, 12.4%); ††percentage of patients with bone pain management-related hospitalizations and ED visits, respectively: All (2.5%, 0.1%), 3L (0.5%, 0.0%), 4L+ (1.8%, 0.3%)

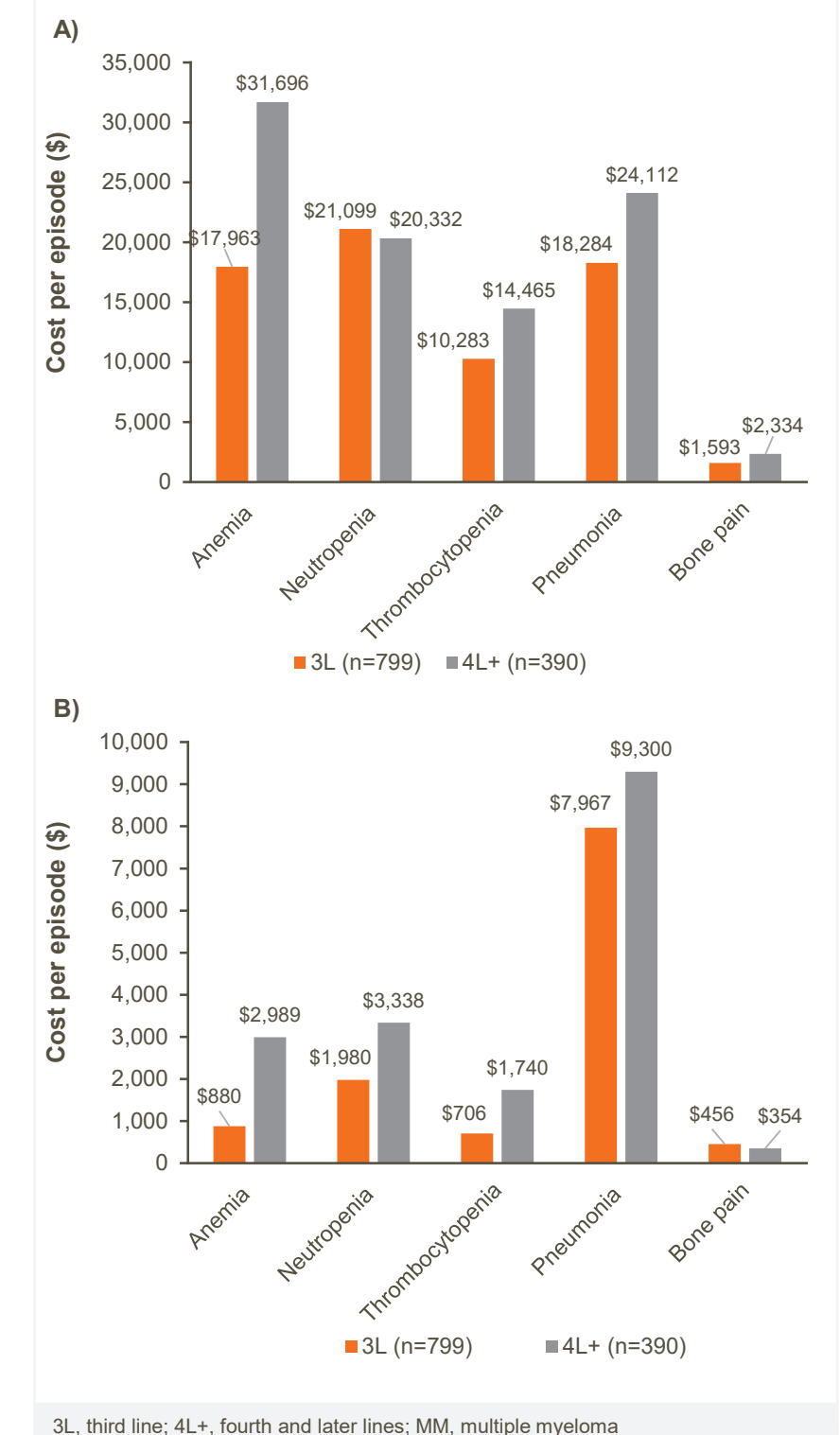
## Conclusions

- Patients in 3L and 4L+ of MM treatment incurred median all-cause total healthcare costs that ranged from \$18,000 to \$22,000 PPPM with higher median outpatient costs for patients at 4L+ versus 3L.
- Median costs of managing frequent MM-associated symptomatic events were broadly similar across LOTs; however, there was trend towards increased costs in later LOTs.
- Frequent MM-associated symptomatic events and event-related costs may be a substantial driver of the cost burden among some patients with MM.
- Additional research should focus on understanding patients with high costs, and indirect costs associated with managing MM and MM-associated symptomatic events that were not addressed in this analysis.

**Figure 1. Proportion of patients with frequent MM-associated symptomatic events (A), and total number of symptom episodes (B) during 3L and 4L+ (incident cohort)**



**Figure 2. Mean (A) and median (B) total frequent MM-associated symptomatic event-related costs per episode in patients during 3L and 4L+ (incident cohort)**



### Abbreviations

1L, first line; 2L, second line; 3L, third line; 4L+, fourth or later line; ED, emergency department; ICD, International Classification of Diseases; LOT, lines of treatment; MM, multiple myeloma; N, number; PPPM, per patient per month; SD, standard deviation.

### Disclosures

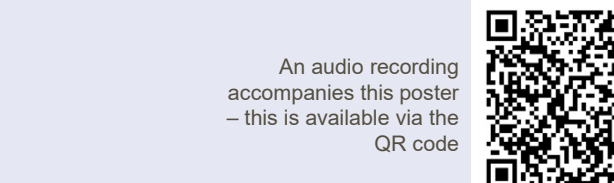
GF, JW, CB, and HS-F are employees of GlaxoSmithKline (GSK) and hold GSK stocks/options. CD, FW, and AB are employees of GSK. ES was an employee of GSK at the time of the study and is currently employed by Medtronic. C-CC and SN are employed by IQVIA, which was hired by GSK to conduct this study.

### Acknowledgments

Programming was provided by Kainan Sun, an employee of IQVIA. This study (HO-18-18615) was funded by GSK. Medical writing assistance was provided by Mary E. Morgan, PhD, at Fishawack Indicia Ltd, UK, and funded by GSK. IQVIA Real World Data Adjudicated Claims database is owned by or licensed to IQVIA® Durham, NC, USA.

### References

- Moreau P, et al. *Ann Oncol* 2017;28(suppl\_4):iv52–iv61.
- Moreau P, et al. *N Engl J Med* 2016;374(17):1621–1634.
- Palumbo A, et al. *N Engl J Med* 2016;375(8):754–766.
- San-Miguel JF, et al. *Lancet Haematol* 2016;3(11):e506–e515.
- Hagiwara M, et al. *Leuk Lymphoma* 2019;1–9.
- Lin HM, et al. *Adv Hematol* 2019;2019:4625787.



An audio recording accompanies this poster – this is available via the QR code

