

ECONOMIC IMPACT OF RELAPSES IN PATIENTS WITH NEUROMYELITIS OPTICA SPECTRUM DISORDER (NMOSD): A SYSTEMATIC LITERATURE REVIEW

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Background

- Neuromyelitis optica spectrum disorder (NMOSD) is an inflammatory axonopathy of the central nervous system characterized by injury to optic nerves, spinal cord, brainstem, diencephalic and cerebral structures.
- NMOSD can cause partial or complete vision loss in one or both eyes, weakness or paralysis in the limbs, and painful spasms. It may also lead to sensory loss, uncontrollable vomiting and hiccups, and bladder or bowel dysfunction due to damage to the spinal cord.^{1,2}
- The treatment strategies for NMOSD include both acute symptom control and long-term maintenance. During acute episodes, intravenous corticosteroids and/or plasma exchange are commonly employed to promptly alleviate symptoms and reduce inflammation, with an aim to mitigate the severity of the acute attack and promote recovery.³
- While several studies have reported the healthcare resource utilization (HCRU) and costs associated with NMOSD, there is currently a lack of published evidence on the influence of attacks on the economic burden of the disease.

Objective

- This study aimed to conduct a systematic literature review (SLR) to assess the economic burden of NMOSD attacks using published literature on HCRU and direct/indirect costs.

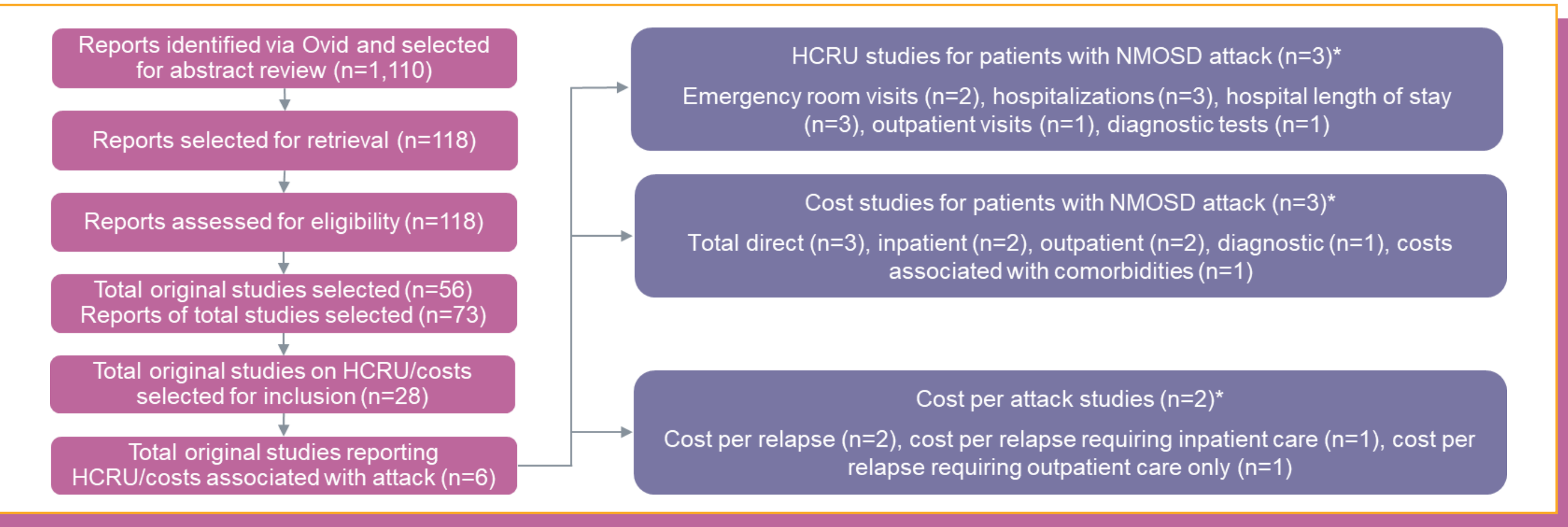
Methods

- This SLR followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.
- Searches were conducted on May 23, 2023, in the Embase, MEDLINE, and Cochrane databases via the Ovid platform to identify studies on HCRU and costs in patients with NMOSD.
- Conference proceedings from the last three years, healthcare technology assessment agency websites, and bibliography searches were used to supplement the results.
- The eligibility of studies was defined in terms of the population, intervention, comparators, outcomes, and study design criteria. No geographic or time limit restrictions were applied.
- Study screening was conducted at both the title/abstract and full-text levels by two independent reviewers with disagreements resolved by a third, independent researcher.
- Data extraction was carried out using a pre-defined Microsoft Excel®-based template. Data were extracted by two independent reviewers and independently checked by a third, senior reviewer.

Results

- Seventy-three reports on 56 original studies were identified by the SLR, of which 28 studies on HCRU/costs were selected for inclusion.
- The studies were further narrowed to those reporting HCRU/costs associated with NMOSD attack.
- In total, six studies⁴⁻⁹ were included in the SLR (Figure 1).
- All six studies were conducted in the United States and were based on database analyses.⁴⁻⁹
- Three studies each reported on HCRU^{4-5,7} and cost^{4-5,6} outcomes for patients with NMOSD attack. Cost per attack were reported by two studies.^{8,9}
- The characteristics of the included studies are shown in Table 1.

Figure 1. HCRU/cost studies identified by the SLR



*Categories are not mutually exclusive
Abbreviations: HCRU, healthcare resource utilization; NMOSD, neuromyelitis optica spectrum disorder

- Reported HCRU included the percentages of patients who had at least one emergency room (ER) visit, hospitalization, outpatient visit, or diagnostic test, as well as hospital length of stay (LOS).
- Reported costs included total cost, inpatient costs, outpatient costs, diagnostic costs, and costs associated with comorbidities.
- The mean annual costs per patient are presented in Figure 3.

Results (cont.)

Table 1. Study characteristics

Study Database	Study period	Length of follow-up, mean	Population size, N	Definition of attack/relapse	Outcomes reported
Foley et al., 2022 ⁴ Magellan database	2016–2020	15.2 months	With attack, 72	≥1 attacks during follow-up from the first claim for NMOSD to end of study period	HCRU, costs
			Without attack, 60		
Gupta et al., 2022 ⁵ IBM Watson Health MarketScan Commercial and Medicare Supplemental Databases	2013–2019	18.0 months	With attack, 102	≥2 relapse events at least 28 days apart during follow-up	HCRU, costs
			Overall NMOSD population, 1,011		
Stafkey-Mailey et al., 2016 ⁶ Administrative claims database	2009–2013	12.0 months	With attack, 582	≥1 attacks during follow-up	Costs
			Without attack, 830 Overall NMOSD population, 1,412		
Ajmera et al., 2018 ⁷ MarketScan Commercial Claims and Encounters database and the MarketScan Medicare Supplemental database	2009–2013	12.0 months	With attack, 134 Overall NMOSD population, 1,349	≥2 relapse events during follow-up after the index date	HCRU
Royston et al., 2021 ⁸ IQVIA PharMetrics Plus Healthcare Claims Database	2012–2019	24 months	Overall NMOSD population, 1,363	Not reported	Cost per attack
Kielhorn et al., 2020 ⁹ US private healthcare claims database	2013–2018	25 months	Overall NMOSD population, 1,118	Not reported	Cost per attack

Abbreviations: HCRU, healthcare resource utilization; NMOSD, neuromyelitis optica spectrum disorder; US, United States

Figure 2. HCRU outcomes



Note: Data that were not reported are denoted by a “–”. Abbreviations: ER, emergency room; CT, computed tomography; LOS, length of stay; MRI, magnetic resonance imaging; NMOSD, neuromyelitis optica spectrum disorder

- Patients with active NMOSD required more frequent ER visits, hospitalizations, outpatient visits, and NMOSD-related computed tomography (CT)/magnetic resonance imaging (MRI) scans. They also had longer annual inpatient LOS compared with patients without attack or the overall NMOSD population (Figure 2).
- Total annual costs were 2.4- to 4.4-fold higher in patients with at least one attack compared with patients without attacks, and 1.8- to 3.3- fold higher compared with the overall NMOSD population (Figure 3).
- Costs for inpatient care was one of the major cost drivers; costs were 2.1- to 2.3-fold higher in patients with at least one attack compared with the overall NMOSD population.
- The overall costs for outpatient and office visits were 1.5- and 1.6-fold higher, respectively, for patients who had attacks compared with the overall NMOSD population.
- Diagnostic costs, including those related to CT/MRI scans and laboratory tests, were 1.8- and 1.9-fold higher, respectively, for patients who had attacks compared with the overall NMOSD population.
- Similarly, costs associated with NMOSD-related comorbidities consistently ranged between 1.7- to 2.2-fold higher among patients who had attacks compared with the overall NMOSD population.

Results (cont.)

Figure 3. Mean annual costs per patient (USD)



Note: Data that were not reported are denoted by a “–”. No standard deviations were reported in these studies.
Abbreviations: CT, computed tomography, MRI, magnetic resonance imaging

- The results for cost per NMOSD attack are shown in Table 2.
- In one study, approximately two-thirds (65%) of attacks required outpatient care only, with a mean duration of 15.9 days (95% CI 15.3, 15.9) and a corresponding mean expenditure of \$4,550 (95% CI \$4,344, \$4,691) per attack.⁸
- In the other, 37% of attacks required inpatient care; mean duration of hospitalization was 14.7 days (95% CI: 12.0, 17.5) and mean expenditure was \$21,121 (95% CI: \$17,551, \$24,692) per attack.⁹

Table 2. Cost per NMOSD attack (USD)

Study	Duration per attack, mean (95% CI)	Total cost, mean (95% CI)		
		Per attack, mean	Per attack requiring outpatient care only	Per attack requiring inpatient care only
Royston et al., 2021 ⁸	17.5 (16.0, 19.4) days	\$25,250 (\$23,664, \$26,957)	\$4,550 (\$4,344, \$4,691)	NR
Kielhorn et al., 2020 ⁹	16.1 (15.3, 16.8) days	\$10,680 (\$9,273, \$12,086)	NR	\$21,121 (\$17,551, \$24,692)

Abbreviations: CI, confidence interval; NR, not reported

Conclusions

- This SLR is the first to investigate the economic burden of NMOSD, with a focus on patients with attack/relapse. The available literature from the US suggests that patients with NMOSD have a substantial economic burden, especially in the inpatient setting. Further research is warranted given the limited number of studies on HCRU and costs.
- Patients with attacks were characterized by substantially higher economic burden as compared to those without attacks, both in terms of costs and HCRU.
- Effective and continuous management of NMOSD to prevent relapses is necessary to mitigate HCRU and the economic burden of disease.

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- LZ, MZ, and MR are employees of Cytel Inc.
- JP, AC, KP, and HP are employees and stockholders of Amgen Inc.
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