The Burden of Pediatric Partial Onset Seizures: A Review of the Literature

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BACKGROUND

- An estimated 470,000 children are living with epilepsy in the United States (US) [1]
- Partial onset seizures (POS) originate in brain networks limited to one hemisphere and are the most common seizure type in all age groups, accounting for more than half of all seizures in children [2]
- There is limited research regarding the burden of epilepsy in the pediatric population

OBJECTIVE

- To better understand the burden of epilepsy among 2- to 12-year-olds, we conducted a targeted literature review summarizing humanistic and economic outcomes. Data specific to POS are presented here.

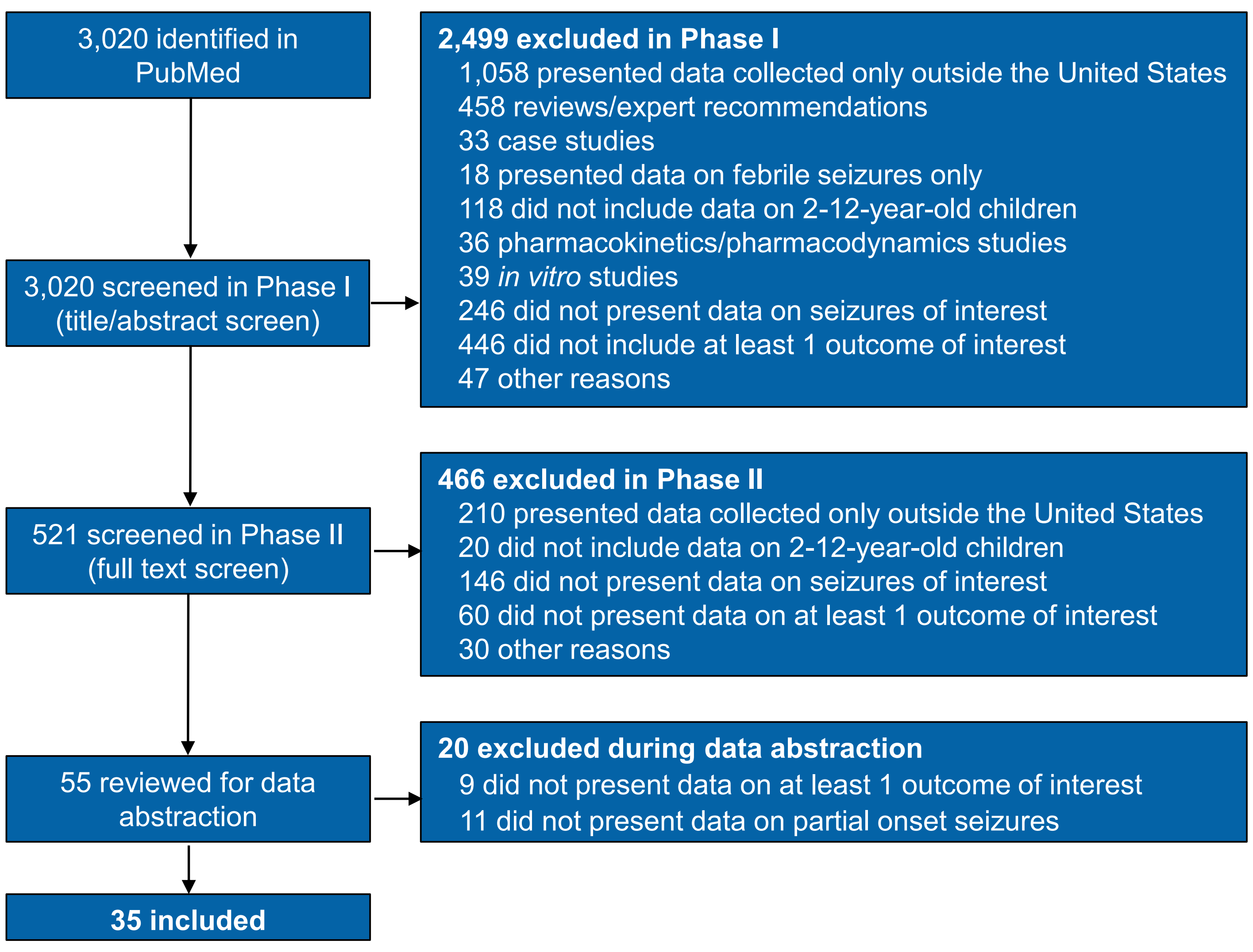
METHODS

- Using MeSH and text words associated with epilepsy and each outcome of interest, we searched MEDLINE (via PubMed) to identify studies:
  - Written in English
  - Published in the last 10 years
  - Presented data collected within the US
  - Included children 2-12 years old with POS or generalized tonic-clonic seizures
  - Presented at least one outcome of interest: incidence, prevalence, mortality, morbidity, quality of life, healthcare utilization, healthcare costs, or medication adherence
- We screened articles in two phases (title/abstract and full-text) and included articles that stratified data by seizure type
- We excluded pharmacokinetics/pharmacodynamics, case series, and in vitro studies
- Data on POS are presented here

RESULTS

- 3,020 studies were identified and screened; 35 presented data on at least 1 outcome of interest among children with POS and are included in this review (Figure 1, Figure 2)
- **Incidence** was 23.2-47.1 per 100,000 children per year. **Prevalence** was 200 per 100,000 children and ranged from 160 to 260 per 100,000 in patients of any age
- No studies reported on national or regional **mortality** rates in children. Life expectancy was 47.3-61.8 years among children 3-12 years old
- **Morbidity**: Patients experienced frequent seizures (in one study 37-47% had seizures more than weekly), sleep disorders, migraine, and seizure-related injuries (e.g., bone fractures, sprains, open wounds). Up to 42%, 19%, and 16% of children with POS had depression, attention-deficit disorder, and anxiety respectively
- Children with POS scored below average on cognitive and **quality of life** assessments. Two studies used the Quality of Life in Children Epilepsy Questionnaire (QOLCE) and found scores to be low (approximately 57 on a 0-100 scale)

Figure 1. Screening flow chart



3,020 identified in PubMed

3,020 screened in Phase I (title/abstract screen)

2,499 excluded in Phase I
1,058 presented data collected only outside the United States
458 reviews/expert recommendations
33 case studies
18 presented data on febrile seizures only
118 did not include data on 2-12-year-old children
36 pharmacokinetics/pharmacodynamics studies
39 *in vitro* studies
246 did not present data on seizures of interest
446 did not include at least 1 outcome of interest
47 other reasons

521 screened in Phase II (full text screen)

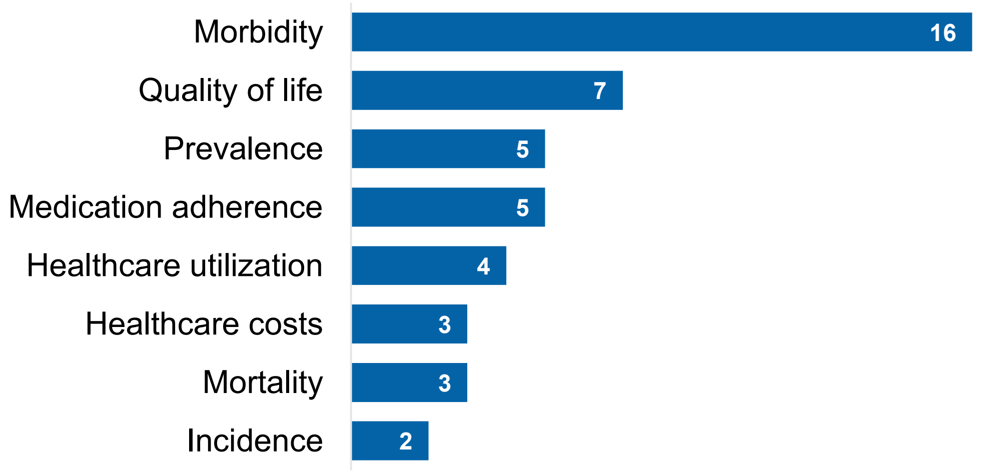
466 excluded in Phase II
210 presented data collected only outside the United States
20 did not include data on 2-12-year-old children
146 did not present data on seizures of interest
60 did not present data on at least 1 outcome of interest
30 other reasons

55 reviewed for data abstraction

20 excluded during data abstraction
9 did not present data on at least 1 outcome of interest
11 did not present data on partial onset seizures

35 included

Figure 2. Number of articles presenting each outcome of interest



8 studies included more than 1 outcome of interest

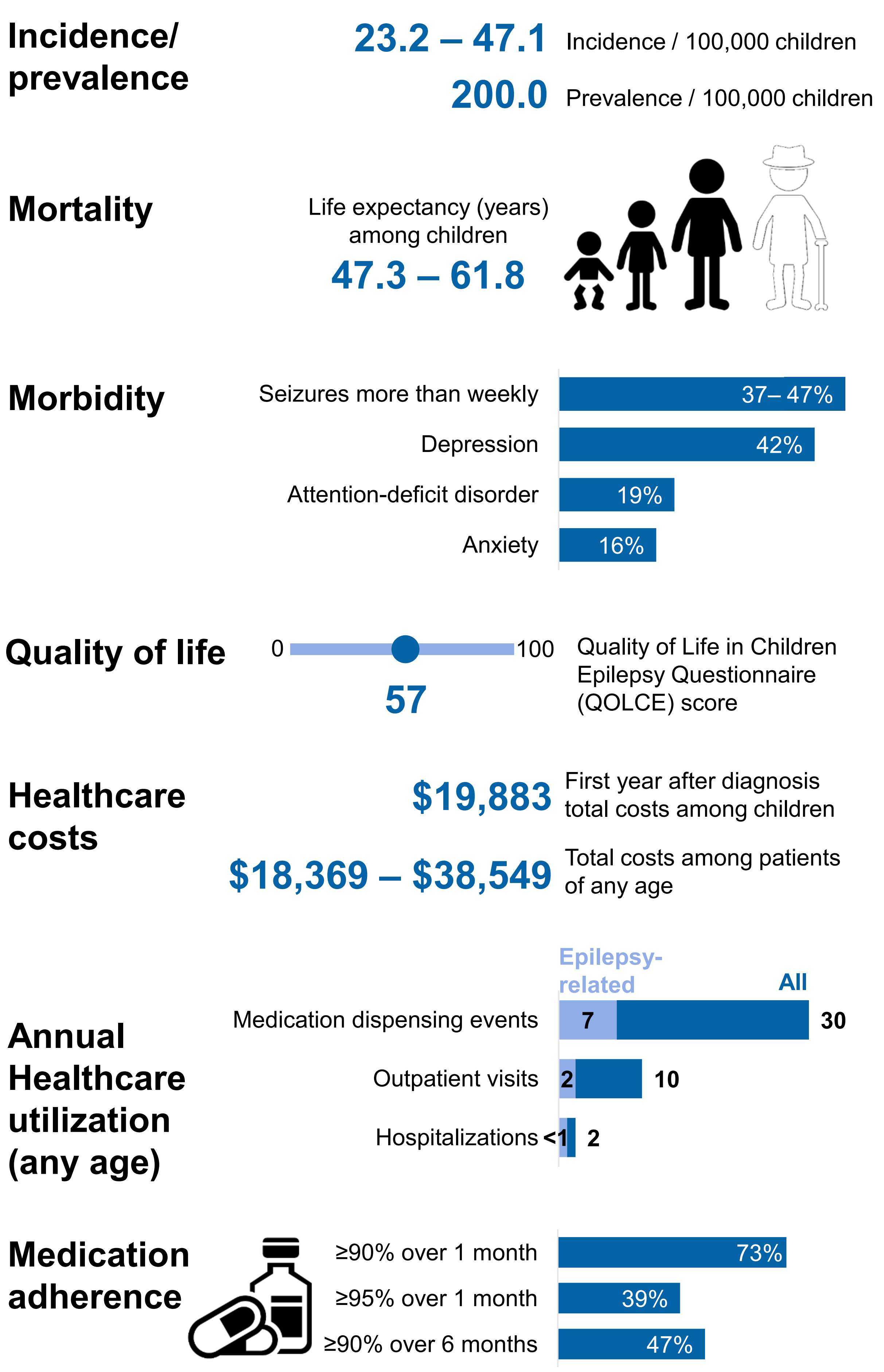
Limitations

- Many studies presented data on patients of all ages, without stratifying by age
- Few studies reported on similar outcomes or used similar measures, making it difficult to consolidate and summarize findings across studies
- Individual reviewers screened studies and abstracted data and did not assess studies for quality or author bias

References
1. CDC. Epilepsy in Children. Published September 18, 2017.
2. Berg AT, Shinnar S, Levy SR, Testa FM. Newly diagnosed epilepsy in children: presentation at diagnosis. *Epilepsia*. 1999;40(4):445-452.
Citations of studies included in the review are available upon request.

- First-year after diagnosis, total **healthcare costs** for children with POS were $19,883. Annual total costs among patients of any age with POS ranged from $18,369-$38,549, and were approximately two times higher in refractory POS (any age)
- Yearly **healthcare utilization** was not reported for the pediatric population. Patients of any age with POS had about 10 outpatient visits (2 epilepsy-related), 30 medication dispensing events (7 epilepsy-related), and 2 hospitalizations per year (less than 1 epilepsy-related)
- **Medication adherence** was low among pediatric patients: In two studies, 73% had ≥90% adherence and 39% had ≥95% adherence over a 1-month follow-up period; in a third study, 47% had ≥90% adherence over a 6-month follow-up period

Figure 3. Key findings



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CONCLUSIONS

- Our study presents a uniquely broad and recent overview of children in the US with POS
- Incidence and prevalence of POS in children are high, similar to that of either pediatric type-1 diabetes or cerebral palsy
- Life expectancy is shortened by decades in these children
- Almost half of children have seizures more than weekly and mood disorders are common. Quality of life is impaired in children
- POS is costly: Using the first-year total healthcare cost for children with epilepsy ($19,883) and the prevalence of POS in children (200 per 100,000), we estimate the yearly healthcare cost for pediatric POS in the US to be $2.9 billion
- Despite high disease burden, medication adherence, which can improve morbidity and decrease healthcare utilization and cost, remains low
- Future studies focusing exclusively on children with POS using healthcare claims data, investigations into indirect costs such as caregiver burden, and qualitative studies to assess quality of life, could more precisely describe the burden of POS in children

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