

Delivery of epilepsy care to adults with intellectual and developmental disabilities

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ABSTRACT

Epilepsy is common in people with intellectual and developmental disabilities (IDD). In adulthood, patients with IDD and epilepsy (IDD-E) have neurologic, psychiatric, medical, and social challenges compounded by fragmented and limited care. With increasing neurologic disability, there is a higher frequency of epilepsy, especially symptomatic generalized and treatment-resistant epilepsies. The causes of IDD-E are increasingly recognized to be genetic based on chromosomal microarray analysis to identify copy number variants, gene panels (epilepsy, autism spectrum disorder, intellectual disability), and whole-exome sequencing. A specific genetic diagnosis may guide care by pointing to comorbid disorders and best therapy. Therapy to control seizures should be individualized, with drug selection based on seizure types, epilepsy syndrome, concomitant medications, and comorbid disorders. There are limited comparative antiepileptic drug data in the IDD-E population. Vagus nerve and responsive neural stimulation therapies and resective surgery should be considered. Among the many comorbid disorders that affect patients with IDD-E, psychiatric and sleep disorders are common but often unrecognized and typically not treated. Transition from holistic and coordinated pediatric to adult care is often a vulnerable period. Communication among adult health care providers is complex but essential to ensure best care when these patients are seen in outpatient, emergency room, and inpatient settings. We propose specific recommendations for minimum care standards for people with IDD-E.

Neurology® 2015;85:1512-1521

GLOSSARY

AED = antiepileptic drug; **IDD** = intellectual and developmental disabilities; **IDD-E** = intellectual and developmental disabilities and epilepsy; **NES** = nonepileptic seizures; **QOL** = quality of life; **RNS** = responsive neurostimulation; **SUDEP** = sudden unexpected death in epilepsy; **TRE** = treatment-resistant epilepsy; **VNS** = vagus nerve stimulator.

Living with intellectual and developmental disabilities (IDD) and epilepsy (IDD-E) holds challenges for the individual, caregivers, and family. Activities of daily living and quality of life (QOL) can be affected by comorbid physical, mental, or cognitive disabilities, as well as epilepsy. Despite progress in care, many problems persist, including a failure to provide medical student and resident education about IDD-E populations. Current adult epilepsy services are often unable to adequately address the needs of this population, who face disparities in health care. Medical science has failed to provide evidence-based data on the care of patients with IDD-E. Randomized controlled trials are needed.

This article, based on a workshop, highlights areas where a greater understanding of the issues and an application of current knowledge could improve the quality of care and QOL in the IDD-E population. We identify areas in which a change in clinical management should be considered and recommend minimum care standards that have excellent face validity but are not evidence-based, reflecting a paucity of rigorous research in this population.

FOCUS ON MANAGEMENT CHANGE The following key questions can be asked of the neurology community, to which a positive answer would undoubtedly lead to major improvements in care of adult patients with IDD-E:

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Go to Neurology.org for full disclosures. Funding information and disclosures deemed relevant by the authors, if any, are provided at the end of the article.

1. Can we improve the education of health care workers about IDD-E?
2. Can we better define the epidemiology and the risk factors for comorbid disorders such as autism spectrum disorder and anxiety disorder?
3. Can we adapt investigative and diagnostic services to enhance access of care?
4. How can we help ease the burden of caregivers?
5. Can adult epilepsy providers improve accurate syndrome diagnosis and complement these with genetic investigation if needed?
6. Should we apply medication (newer antiepileptic drugs [AEDs]), dietary, and surgical assessment and treatment for the same indications and extent as in epilepsy patients without IDD?
7. How should we measure physical, cognitive, and behavioral side effects of epilepsy treatment?
8. Are psychiatric classifications and diagnostic criteria valid?
9. Do psychiatric care resources adequately provide the expertise needed for care?
10. Do patients and caregivers have an emergency treatment plan and longitudinal plan of care?
11. Is research to assess and treat patients with IDD-E commensurate with the problem?

NATURE OF THE EPILEPSY Factors such as chronicity, etiology, syndrome, and seizure type differ between the adult IDD-E and general epilepsy populations. These factors may be influenced by the severity of the IDD. The epilepsy usually begins in childhood. In a UK primary care population of 354,000 adults and children, 374 adults with IDD were identified; among those who consented, 18% (58/318) had epilepsy and 92% had childhood-onset epilepsy.¹

The age at onset of the epilepsy may be influenced by etiology. In Down syndrome, for example, the 2 peaks of epilepsy onset are infancy (often infantile spasms) and mid-adulthood (often myoclonic seizures shortly before dementia).^{2,3} This second peak reflects the increasing life expectancy, from 5 years in 1955 to over 55 years at present.

The prevalence of epilepsy increases with the severity of the IDD. Among 692 patients with childhood-onset epilepsy followed for 20–30 years, 147 (21%) had IDD-E.^{4,5} Of these 147 IDD-E cases, 53% had severe/profound IDD compared to 24% with moderate IDD and 24% with mild IDD.⁴

Seizure type is also influenced by the severity of the IDD. Focal epilepsies predominate in those with mild IDD (69%; 17% with symptomatic generalized epilepsy), similar to those with normal intelligence, while symptomatic generalized epilepsies predominate in those with severe IDD (67%; 29% with focal

Table 1 Role of IDD in epilepsy types and remission

	Remission, %	Intractable epilepsy, %
All epilepsies		
Mild IDD	49	14
Moderate IDD	32	38
Severe/profound IDD	24	55
Focal epilepsy only		
Normal intelligence	68	15
Mild IDD	57	10
Moderate IDD	28	30
Severe/profound IDD	28	44

Abbreviation: IDD = intellectual and developmental disabilities. Remission of Epilepsy in Nova Scotia study: severity of the IDD.⁵

epilepsy).⁵ More than 30% of people with IDD-E have symptomatic generalized epilepsies that do not match a defined syndrome.⁵ Epilepsy in those with moderate and severe/profound IDD is often more severe and treatment-resistant than in those with mild IDD (table 1; $p = 0.004$),⁵ who have similar long-term epilepsy outcomes to those with normal intelligence (table 1).

Some childhood-onset syndromes continue into adulthood with different features. Lennox-Gastaut is less easily defined in adults than children.⁶ The early characteristic slow spike-wave discharges on EEG tend to vanish in adulthood and are replaced with multifocal spikes. Tonic seizures during sleep often persist with generalized fast spikes; however, clinical drops, absence, and myoclonus become less frequent. Adult seizures may be predominantly focal or generalized tonic-clonic.

Epilepsy histories in adults with IDD are challenging, especially when the caregiver has limited knowledge of the patient. Important diagnostic details may be unavailable. For example, a history of status epilepticus in the first year of life with fever or after vaccination, or exacerbation of seizures with carbamazepine, would suggest Dravet syndrome.

Successful care of adults with IDD-E depends on applying recent advances in genetic evaluation, ongoing epilepsy and treatment impact, collecting accurate data, addressing psychological comorbidity, and optimizing care transition.

GENETIC EVALUATION Identifying the etiology. IDD often results from genetic causes, including copy number variants, Mendelian disorders, and de novo mutations. Karyotyping and genetic sequencing of IDD-related genes (e.g., trisomy 21

Table 2 Examples of recurrent copy number variants associated with ID, epilepsy, and other neurodevelopmental phenotypes^{50,51}

Copy number variant	Deletion or duplication	Associated phenotypes
1p36	Deletion/duplication	ID, ASD (Del), EPI (Del)
1q21.1	Deletion/duplication	ID, ASD, SCHZ, EPI
2p16.3	Deletion	ID, SCHZ, EPI
2q13	Deletion/duplication	ID, ASD, EPI (Del)
2q37	Deletion	ID, ASD, EPI
3q29	Deletion/duplication	ID (Del), SCHZ, EPI (Del)
4p16.3 (Wolf-Hirschhorn syndrome)	Deletion	ID, EPI
4q21.21-q21.22	Deletion	ID, ASD, EPI
5q35.2-q35.3 (Sotos syndrome)	Deletion	ID, EPI
7q11.22-q11.23	Deletion/duplication	ID, EPI, ASD (Dup)
9q34.3 (9q subtelomeric syndrome)	Deletion	ID, ASD, EPI
15q11.2	Deletion	ID, ASD, SCHZ, EPI
15q11-q13 (Prader-Willi/Angelman syndrome)	Duplication/deletion	ID, ASD (Dup), SCHZ (Dup), EPI
15q13.3	Deletion/duplication	ID, ASD, SCHZ (Del), EPI
16p11.2	Deletion/duplication	ID, ASD, SCHZ (Dup), EPI
16p12.1	Deletion	ID, ASD, EPI
16p13.11	Deletion/duplication	ID, SCHZ (Dup), EPI (Del)
17p12-p11.2 (Potocki-Lupski/Smith Magenis syndromes)	Deletion/duplication	ID, ASD (Dup), EPI
17p13.3-13.2 (Miller-Dieker syndrome)	Deletion	ID, ASD, EPI
17q12	Deletion/duplication	ID, ASD, SCHZ (Del), EPI
17q21.3	Deletion	ID, ASD, EPI
22q11 (Velocardiofacial/DiGeorge syndrome)	Deletion/duplication	ID, ASD (Dup), SCHZ (Del), EPI
22q11.2	Deletion	ID, ASD, EPI
22q13 (Phelan-McDermid syndrome)	Deletion	ID, ASD, EPI
Xp22.1	Deletion	ID, ASD, EPI

Abbreviations: ASD = autism spectrum disorders; EPI = epilepsy; ID = intellectual disability; SCHZ = schizophrenia.

and *FMRI* repeats in fragile X) are standard diagnostic tools. Genetic syndromes with copy number variations (duplications and deletions) can be identified with chromosomal microarray analysis. In highly recurrent copy number variants, candidate genes for both IDD and epilepsy have been identified in duplicated or deleted regions. Causative copy number variants occur in 15%–20% of unexplained IDD or multiple congenital anomalies (table 2)⁷ and are commonly found in patients with autism spectrum disorder and epilepsy.^{8,9} Hotspots in chromosomes 15 and 16 for such variants are common in patients with IDD, autism spectrum disorder, and epilepsy.⁹ Chromosomal microarray analysis is covered by most insurances and this first-line test can help diagnose unexplained IDD-E.

Gene panels can identify causes of IDD, autism spectrum disorder, and epilepsy due to Mendelian disorders or de novo mutations. These tests are expensive and may not be covered by some insurers. When a suspected disorder may impact therapy (e.g., tuberous sclerosis, *SCN1A* mutation), a stronger argument for testing can be made. Whole-exome sequencing is best arranged by a clinician with genetics expertise, as variants of uncertain significance are common. When variants are found, testing of the biological parents can help determine whether the mutation is inherited or de novo.

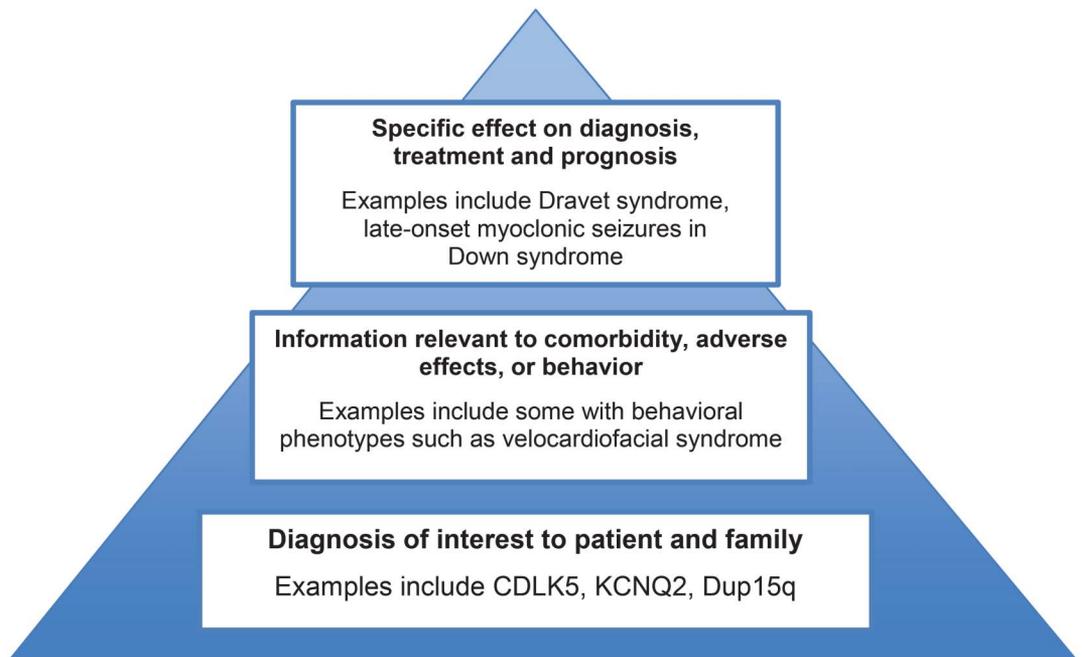
Does genetic information affect clinical care? Many adults with IDD-E have genetic disorders for which identification can (1) have an immediate impact on diagnosis, treatment, and prognosis, (2) identify preventable or treatable comorbid disorders, (3) inform the family about genetic counseling, (4) provide an explanation that relieves guilt, and (5) provide patient and caregiver support through syndrome-specific advocacy groups (figure 1). Soon, medications may treat nonsense (premature stop codon) haploinsufficiency mutations (e.g., *SCN1A*, *CDKL5*).

METABOLIC ASSESSMENT Nearly 90 treatable metabolic disorders can present with IDD¹⁰; many cause epilepsy. Screening for these disorders can be done in 2 phases. Initial assessment with urine and blood tests can identify up to 60% of all treatable inborn errors of metabolism. Secondary investigations are determined on individual clinical features and often obtained after consultation with a geneticist or metabolic specialist. An app to assist with this investigation provides a diagnostic algorithm (www.treatable.id.org).

TREATMENT IMPACT Many people with IDD-E have treatment-resistant epilepsy (TRE) with generalized or multifocal seizures that are not surgically amenable. Video-EEG, when feasible to perform, can confirm the seizure type and epilepsy syndrome and assess nonepileptic seizures (NES), medication toxicity, and other diagnostic challenges. The interplay of seizure reduction, EEG improvement, and side effects make it difficult to define the AED effects in this population. Impairments in cognition, behavior, and coordination due to AEDs may be wrongly attributed to the underlying IDD, termed diagnostic overshadowing.

Thirteen randomized controlled studies with 899 patients with IDD-E studied carbamazepine, clobazam, felbamate, gabapentin, lamotrigine, rufinamide, and topiramate.^{11,12} No features distinguished AEDs with respect to efficacy or side effects. The Cochrane

Figure 1 Hierarchical impact of genetic diagnoses on treatment of epilepsy and comorbid disorders



Hierarchical impact that genetic diagnoses can have on treatment of epilepsy and comorbid disorders in patients with intellectual and developmental disabilities and epilepsy. For almost all cases, genetic diagnosis provides answers and connects families to a community. In a smaller number of cases, genetic diagnosis can improve recognition of comorbid disorders and therapeutic choices.

reviewers advised making epilepsy care decisions based on etiology and standard practice, not the IDD.¹¹

Less rigorous studies have yielded similar, often mixed results. Lamotrigine may improve aggression, mood, and alertness when compared to other AEDs.¹³ However, individual responses vary considerably, and all AEDs can cause behavioral toxicity in patients with IDD-E, including generally well-tolerated ones such as lamotrigine¹⁴ and gabapentin.¹⁵

Treatment algorithms and recommendations based on literature review and clinical experience suggest several maxims.^{16,17} AEDs with potential benefits on comorbid mood disorders in IDD-E, based largely on anecdotal observations, include valproate, lamotrigine, and oxcarbazepine.^{13–15} Treatment should focus on the underlying epilepsy syndrome^{11,16,17} and take into account prior attempts to withdraw AEDs (e.g., did they precipitate status?).

The use of dietary therapies in adults with IDD-E is far less common than in childhood, possibly due to adherence problems. The modified Atkins diet has expanded dietary therapies to adults.¹⁸ This high fat, very low carbohydrate diet is initiated as an outpatient, with carbohydrate restriction but no limits on protein, fluid, or calorie intake. Adult epilepsy dietary programs can transition adolescents on dietary therapy, providing a medical home for these adults who require this complicated treatment. Adults with

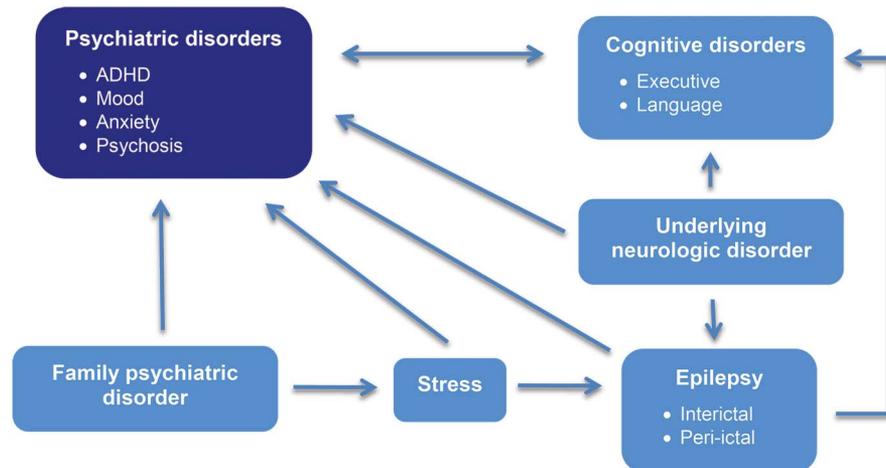
IDD-E can do well on the modified Atkins diet, similar to other adults without disability (E.H. Kossoff, MD, unpublished data, 2015).

VAGUS NERVE STIMULATION Vagus nerve stimulator (VNS) may help patients with IDD-E since a partial reduction in seizure frequency or intensity or AEDs can improve QOL. Uncontrolled trials suggest VNS is effective and well-tolerated by diverse IDD cohorts, including Lennox-Gastaut syndrome and autism spectrum disorder.¹⁹

Caregivers may fear that lack of an aura or inability to use the magnet themselves may render the device ineffective. However, the magnet can be used by caretakers and its efficacy remains unproven. Nonverbal patients can usually express discomfort through vocal or facial expressions which can be linked to the VNS on cycle. Impaired voice quality is not an issue for nonverbal patients.

RESPONSIVE NEUROSTIMULATION The responsive neurostimulation (RNS) device is an adjunctive therapy for TRE in individuals 18 years of age or older with focal seizures who have 1 or 2 epileptogenic foci. During the pivotal blinded study, there was a 38% seizure reduction in RNS vs 17% in the sham treatment. In the open-label phase, there was a 44% reduction after 1 year and 53% after 2 years.²⁰ Among 8 subjects who had an IQ <70, there was no

Figure 2 Factors contributing to the genesis and persistence of psychiatric disorders in patients with intellectual and developmental disabilities and epilepsy



ADHD = attention-deficit/hyperactivity disorder.

difference in responder rate for seizure reduction compared to the group with higher IQ (M. Morrell, MD, personal communication, 2015).

EPILEPSY SURGERY Historically, patients with moderate to severe cognitive impairment were considered poor candidates for epilepsy surgery due to presumed multilobar dysfunction.¹⁶ However, among children and adults with TRE and a localized epileptic focus, IQ does not predict surgical outcome.²¹

In syndromes such as tuberous sclerosis with IDD and multiple structural and potentially epileptogenic lesions, removal of a dominant focus or even bilateral foci can markedly reduce or completely control seizures.²² Functional hemispherotomy can be curative. Callosotomy and multiple subpial resections may improve seizure control.

MORTALITY AND COMORBIDITIES Common causes of mortality in IDD-E include cardiovascular disease, respiratory infections, cancer, epilepsy, and accidents. In a UK survey of IDD, the median age of death was 13 years younger in male and 20 years younger in female patients compared to the general population²³; 37% of the deaths were avoidable. Factors contributing to premature mortality include problems in advanced care planning, failure to address mental health issues, living in inappropriate accommodation, adjusting care as needs changed, and caregivers not feeling listened to.

Patients with IDD-E have comorbid disorders that impact epilepsy and its management. Collaborating with medical doctors and specialists experienced with the IDD population can improve care. Commonly overlooked morbidities in IDD-E include gastrointestinal, gynecologic, urologic,

psychiatric, dental, sensory (e.g., visual, auditory), polypharmacy, and sleep disorders, as well as neglect and abuse, falls, and injuries.

Sleep disorders occur in 30%–60% of adults with IDD and are often undiagnosed.²⁴ These include insomnia, apnea, circadian rhythm, parasomnias, and daytime hypersomnia disorders. Severity of IDD, cerebral palsy, and epilepsy are associated with an increased risk of sleep disorders.²⁵ Contributing factors to sleep disorders in IDD-E include muscle spasms, musculoskeletal pain, inability to change body position at night, medications, visual impairment, glossopteris, or abnormal upper airway leading to obstructive sleep apnea, reflux, and aspiration pneumonias, and psychological/behavioral factors.²⁵

Psychiatric disorders result from the underlying etiology of IDD, epilepsy (peri-ictal dysfunction, forced normalization), genetics, AEDs and other medications, and living circumstances (figure 2).²⁶ Psychiatric disorders often impair QOL more than seizures. Patients with IDD-E are 7-fold more likely to develop psychiatric disorders than those with IDD only, supporting the etiologic role of epilepsy.²⁶ Environment should be considered. For example, antagonistic relations with housemates can fuel depression or aggression that is often best managed without medication.²⁷ Psychiatric and psychological evaluations are often essential. Behavioral therapies, psychotropic medications, and environmental changes should all be considered. Psychotropic medications are often underutilized in IDD-E and other epilepsy patients due to unfounded fears that these medications commonly provoke seizures. Psychotropic drugs are safe and effective in epilepsy patients.²⁸ For patients on chronic psychotropic medication, re-evaluation to

Table 3 Minimum care standards for adults with intellectual and developmental disabilities and epilepsy

Health care providers should be educated about the medical, cognitive, and behavioral comorbidities
Health care providers should be instructed to be patient-centered in communication: for example, to make eye contact, to speak to the person even if he or she is nonverbal, and to show the same respect as for any other patient
In every patient, the diagnosis should be carefully assessed, no matter what the age of the patient, with regards to underlying cause, epilepsy syndrome, and comorbid disorders
Consider genetic disorders that could impact therapy (e.g., Dravet syndrome)
Consider atypical presentations of epilepsy syndromes (e.g., Lennox-Gastaut syndrome without slow spike and wave or daytime tonic seizures)
Autism spectrum and other psychiatric disorders are often comorbid; their identification may improve care access and help tailor therapy
As children reach adolescence, they and their caregivers should be educated about their care and transition to adult care should be planned in advance; adult epilepsy specialist care is usually required
Families should be educated on the nature of adult epilepsy care and an adult care provider identified
A brief personal and medical summary should be prepared and updated annually, and be available for all individuals involved in the care of the patient with IDD-E; this should include past and current diagnoses, medications and beneficial/adverse effects, allergies, and personal preferences (e.g., ways to calm the patient in a stressful setting)
Assess the AED regimen efficacy and safety during every clinical visit; consider misattribution of AED side effects to the IDD (diagnostic overshadowing)
For patients with treatment-resistant epilepsy, consider dietary or surgical therapies
Consider preventive strategies to reduce chances of injury or premature death, including risk from injury, drowning, and SUDEP; assess living accommodations and consider social work involvement if needed
Consider the needs of family members and the potential burden they are experiencing and refer for support as needed
An individualized seizure emergency management plan should be part of the medical summary
Integration of care among all health providers, with one provider identified as the coordinator; care should always include careful listening to the patient with IDD-E and inclusion of his or her input with respect to care decisions
Mental health should be reviewed at every visit; referral to mental health support should be considered when concerns arise
Ongoing awareness is needed to assess for changes in neurologic and medical health; be aware of red flags such as weight loss, behavior change, and loss of appetite for unrecognized physical comorbidity

Abbreviations: AED = antiepileptic drug; IDD = intellectual and developmental disabilities; IDD-E = intellectual and developmental disabilities and epilepsy; SUDEP = sudden unexpected death in epilepsy.

assess the necessity of ongoing, often polytherapy should be done at least once a year.

AEDs are a common and remediable cause of psychiatric disturbances (e.g., hyperactivity, irritability, and aggressive behavior) in patients with IDD-E. While any AED at high doses can change behavior, several AEDs are prone to cause psychiatric symptoms in vulnerable patients (e.g., previous or family psychiatric history); these AEDs include GABAergic drugs (barbiturates,²⁹ benzodiazepines,³⁰ vigabatrin, tiagabine,³¹ and levetiracetam).^{16,32} Much of these data are anecdotal.

In patients with IDD-E, high seizure frequency, tonic-clonic seizures, and AED polytherapy are associated with behavioral disorders.³³ The most frequent expressions of psychopathology in people with IDD-E are aggressive, impulsive, and oppositional behavior, although mood, anxiety, and psychotic disorders are also common. We lack evidence-based treatment algorithms in the IDD or IDD-E populations³⁴ to treat agitation, self-injurious behaviors, and other forms of aggression. Whenever possible, physical and pharmacologic restraint should be avoided or minimized. Behavioral interventions (e.g., antecedent interventions, differential reinforcement, extinction, functional

communication, response interruption)³⁵ and regular exercise may be very helpful.²⁷

Misdiagnosis is common. Stereotyped behaviors can be confused as aggressive behavior or a sign of a seizure. Stereotypies may be the expression of self-stimulation or a movement disorder. NES are common in people with IDD-E. In populations of patients with NES, 30%–40% have IDD and concomitant epilepsy.³⁶

EPILEPSY IMPACT: MORBIDITY AND MORTALITY

Epilepsy complications may result from seizures, therapies to control seizures, or the underlying etiology. Patients with IDD and comorbid epilepsy have 2–3 times the utilization of inpatient, outpatient, and accident/emergency visits than those with IDD alone.³⁷ More data on patients with IDD-E are needed, and most of what follows refers to individuals with epilepsy, not IDD-E.

Seizure-related injury. A prospective, multicenter, case-control study found an increased injury rate in persons with epilepsy vs controls (27% vs 17%, $p < 0.0001$).³⁸ The risk in multi-handicapped adults with epilepsy in nursing homes was greater: one-third sustained a seizure-related injury over 13 months.³⁹

Seizures may result in injury due to falls or altered awareness impairing response to dangerous situations. Risk factors for falls in people with IDD may include older age, impaired mobility, epilepsy, and behavioral problems.⁴⁰ Accidental injury may also result from AED toxicity, osteoporosis exacerbated by medication and immobility due to IDD, attention-deficit disorder, and impaired motor function. Soft tissue injuries are the most common injury sustained with seizures. Most are mild, with only 5% requiring medical attention.³⁸ Fractures, most significantly hip and femur, are increased 2- to 6-fold in an epilepsy cohort vs the general population.⁴¹

Drowning. In the preceding year, 14% of adults with active epilepsy sustained a seizure while bathing or swimming.⁴² Drowning deaths most often occurred with unsupervised baths. We recommend (1) taking showers rather than baths, (2) avoiding pop-up/down drains in the shower, (3) careful supervision around water, and (4) life jackets during water activities on or around lakes and open water.

Burns. Seizure-related burns account for 1.6%–3.7% of burn unit admissions.⁴¹ Risk factors for burns include higher number of lifetime seizures, absence of neurologic impairment, and seizures that impair consciousness with or without secondary generalization.⁴¹

Head injury. Concussion rate is elevated in patients with epilepsy compared to controls.³⁸ The risk is greater in adults with chronic epilepsy, especially if seizures cause falls. While helmets are often recommended for patients with recurrent seizure-induced falls, their efficacy remains unproven.

Strategies to minimize risk of accidental injury. Injury risk is greatest in persons with generalized seizures without auras and high seizure frequency. Counseling on risks of submersion injury and water safety is essential. Vitamin D supplementation and encouraging outdoor activities and regular physical exercise promotes bone health. For those with TRE, minimizing use and exposure to heated appliances and limiting hot water settings may reduce risk of burns. Environmental measures can reduce risk of falls.

SEIZURE-RELATED DEATH **Status epilepticus.** Mortality due to status epilepticus is higher in epilepsy syndromes characterized by recurrent status epilepticus. For example, one-third of deaths in Dravet syndrome were attributed to status epilepticus⁴³ compared to 6%–16% for epilepsy overall.⁴⁴

Sudden unexpected death in epilepsy. Sudden unexpected death in epilepsy (SUDEP) is the most common cause of death among people with TRE. The

risk of SUDEP increases with the frequency of generalized tonic-clonic seizures. Symptomatic epilepsy and IDD are risk factors for SUDEP.^{45–47} Supervision, especially at night, may reduce SUDEP in children and adults with IDD-E.⁴⁸ Since most SUDEPs occur in sleep and patients are in the prone position, seizure monitors that can alarm caregivers may help to reduce SUDEP risk, but this remains unproven.⁴⁸

CRITICAL ISSUES IN CARE DELIVERY **Transition from pediatric to adult care.** Medical transition is a dynamic longitudinal process that is disruptive and stressful for patients and families. Many child neurology providers do not utilize a transition process. IDD-E increases the need for parental involvement in care. Plans must be made for adults with IDD-E who live with elderly parents. Transition clinics, usually in the adult medical setting, promote self-determination and positive transition. Many adult neurologists are uncomfortable with IDD patients. Gaps remain in access to expertise in IDD-E for some patients living in rural regions or with lower socioeconomic resources. Formal training about IDD care should become a part of all neurology and epilepsy training programs.

Data and communication. Support and care for adults with IDD-E are often provided by aging parents, rotating group home staff, and institutional care providers. Accurate clinical information is often difficult to obtain, a challenge exacerbated by language and cognitive impairments. Clinicians should always make eye contact with patients, ask questions even if patients are nonverbal since comprehension usually exceeds expressive skills, and use person-first language (“person with disabilities,” not “disabled person”) as signs of respect and caring.

Caregiver relations. The burden of caregivers is enormous and is rarely appreciated by health care workers. Stress can result from financial concerns, witnessing and providing care for seizures and status epilepticus, behavioral and mood disorders, provision of overall care (e.g., bathing), managing incontinence and spasticity, and scores of other challenges. Aging parents benefit from social service referrals and support groups.

Emergency and hospital care. The high rate of hospitalization among the IDD-E population could be reduced through preventive measures and regular ambulatory care. Emergency care is often for seizures, seizure clusters and status epilepticus, seizure-related injuries, medication toxicities, or behavioral crises. Adults living with family or in long-term care facilities may be managed without

hospitalization as families and health care workers become expert with acute seizure management. Residents of community-based group homes often use the emergency ward since staff have high turnover and limited experience.

Barriers to medical care in patients with IDD include limited communication, agitation in unfamiliar and overstimulating hospital environments, and physical and neurologic impairments confounding assessment of physical or cognitive changes. Extrinsic barriers include limited or inaccurate medical history and test data, as well as access to specialized centers. Written or electronic summaries of the patient's history are invaluable.

Management during hospitalizations. In the emergency ward or hospital, patients with IDD-E should be managed with as few restrictions and as much familiarity as possible (e.g., known companion, familiar foods). Calmly explaining procedures step-by-step can help even nonverbal patients. Agitation or poor cooperation may lead to pulling off EEG

electrodes or IV access. Patients trying to get out of bed are at risk of falling. Established protocols help to manage these problems as well as aggression.

Intermittent ambulation can help preserve strength and reduce risk of deep vein thrombosis. Recreation therapy is helpful. The family and other caretakers should be regularly informed during hospitalization with clear discharge instructions including medication changes and potential side effects.

Emergency seizure management. Every patient should have a written seizure action plan including emergency contact information, preferred hospital, medication doses, and allergies. Caregivers should know basic seizure first aid and how to treat prolonged or clustered seizures (rescue medication dose and repeated use, and when to call for emergency medical services). Physicians need to consider causes of worsening seizure control (e.g., nonadherence, hydrocephalus, low AED levels).⁴⁹

Minimum care standards for adults with IDD-E. Our recommendations to improve the health care of adults with IDD-E are summarized in table 3.

Comment: Improving the care of people with epilepsy and intellectual disabilities

Epilepsy and intellectual disabilities are both relatively common in the general population, each affecting between 0.5% and 1%. Both conditions share a common heritage of heterogeneity, dearth of care expertise outside major centers, and an unfortunate degree of stigmatization.¹ They are often comorbid, as up to one-third of people with active epilepsy have an intellectual and developmental disability and up to half of people with a severe intellectual and developmental disability may have a seizure disorder. There is clearly a paucity of authoritative studies on most aspects of this common association and this is particularly true for assessments of effective management.¹ This limitation reduces the quality of care of these individuals, and thus their quality of life, also affecting other involved persons, such as families, and, potentially, their careers.

The review by Devinsky et al.,² which is the outcome of an experts' workshop, is an attempt to highlight areas where a greater understanding of issues affecting the care of people with comorbid epilepsy and intellectual disabilities could lead to improvements. It summarizes the major issues and identifies several areas where changes in clinical management should be considered. A set of minimum care standards is recommended, some of which are self-evident and equally applicable to all people with epilepsy regardless of comorbidity, but some are specific depending on the putative etiology.² It could be said that most of the comments and recommendations are common sense, but nevertheless it is good to see them clearly delineated. Hopefully this will sow a seed of improvement in the care of these people and may lead to studies that will provide evidence, which is still missing.

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Study funding: No targeted funding reported.

Disclosure: J.W. Sander has served on advisory boards for UCB and Eisai; has received speaker honoraria from GSK, Eisai, UCB, Lundbeck, and Teva; serves on the editorial board of *Lancet Neurology*; and receives research support from the Dr. Marvin Weil Epilepsy Research Fund, Epilepsy Society, Netherlands Epilepsy Funds, Eisai, GSK, WHO, and EU FP7. His current position is endowed by the UK Epilepsy Society. Go to Neurology.org for full disclosures.

AUTHOR CONTRIBUTIONS

Orrin Devinsky: drafting/revision of the manuscript, study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval. Miya R. Asato: drafting/revision of the manuscript, accepts responsibility for conduct of research and final approval. Peter R. Camfield: drafting/revision of the manuscript, analysis or interpretation of data, accepts responsibility for conduct of research and final approval. Eric B. Geller: drafting/revision of the manuscript, accepts responsibility for conduct of research and final approval. Andres M. Kanner: drafting/revision of the manuscript, study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, acquisition of data. Seth Keller: drafting/revision of the manuscript, study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, contribution of vital reagents/tools/patients, study supervision. Michael Kerr: drafting/revision of the manuscript, study concept or design, accepts responsibility for conduct of research and final approval. Eric H. Kossoff: drafting/revision of the manuscript, accepts responsibility for conduct of research and final approval. Heather A. Lau: drafting/revision of the manuscript, accepts responsibility for conduct of research and final approval, provided background/literature search/interpretations and wrote for the genetics portion of this paper and helped edit the draft. Sanjeev Kothare: drafting/revision of the manuscript, accepts responsibility for conduct of research and final approval. Baldev Singh: drafting/revision of the manuscript, study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, contribution of vital reagents/tools/patients. Elaine C. Wirrell: drafting/revision of the manuscript, accepts responsibility for conduct of research and final approval, acquisition of data.

STUDY FUNDING

No targeted funding reported.

DISCLOSURE

O. Devinsky receives research support from GW Pharma. M. Asato received grant support from Health Resources and Services Administration. P. Camfield, E. Geller, A. Kanner, and S. Keller report no disclosures relevant to the manuscript. M. Kerr received an honorarium from UCB Pharmaceuticals. E. Kossoff has served as a paid consultant for Atkins Nutritionals, Lundbeck, Eisai, and NeuroPace and received grant

support from Nutricia. H. Lau, S. Kothare, B. Singh, and E. Wirrell report no disclosures relevant to the manuscript. Go to [Neurology.org](#) for full disclosures.

Received January 23, 2015. Accepted in final form May 28, 2015.

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