Clinical review:

Concomitant use of EPIDIOLEX® (cannabidiol) and clobazam in the treatment of Lennox-Gastaut syndrome (LGS)

LGS is a severe epileptic and developmental encephalopathy associated with a high rate of morbidity and mortality. Patients experience frequent treatment-refractory seizures.^{1,2}

Patients living with LGS have often tried a variety of pharmacological and non-pharmacological therapies, often in combination.^{1,2}

EPIDIOLEX and clobazam are both indicated for the treatment of seizures associated with LGS:

EPIDIOLEX

EPIDIOLEX is indicated for the treatment of seizures associated with LGS, Dravet syndrome, or tuberous sclerosis complex (TSC) in patients 1 year of age and older.³

Clobazam

Clobazam is indicated for adjunctive treatment of seizures associated with LGS in patients 2 years of age or older.⁴

This clinical review presents data on concomitant use of EPIDIOLEX and clobazam to help inform clinical decisions

INDICATIONS & IMPORTANT SAFETY INFORMATION

INDICATIONS:

EPIDIOLEX (cannabidiol) oral solution is indicated for the treatment of seizures associated with Lennox-Gastaut syndrome (LGS), Dravet syndrome (DS), or tuberous sclerosis complex (TSC) in patients 1 year of age and older.

CONTRAINDICATION: HYPERSENSITIVITY

EPIDIOLEX (cannabidiol) oral solution is contraindicated in patients with a history of hypersensitivity to cannabidiol or any ingredients in the product.

Please see Important Safety Information throughout and on page 11 and the full <u>Prescribing Information</u>.

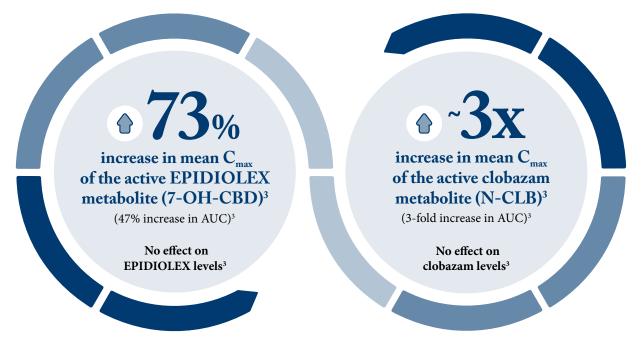


EPIDIOLEX & clobazam as treatment partners

EPIDIOLEX and clobazam have a bidirectional pharmacokinetic relationship³

Each compound selectively increases exposure to the major active metabolite of the other without affecting parent drug levels³

Clobazam effect on EPIDIOLEX EPIDIOLEX effect on clobazam



In a preclinical seizure model, the active metabolite 7-OH-CBD was 5-fold more potent than CBD⁵

Based on preclinical studies, the active metabolite N-CLB is estimated to be from 1/5 to equal the potency of clobazam⁴

The addition of EPIDIOLEX with clobazam may increase the risk of clobazam-related adverse reactions. Consider a reduction in dosage of clobazam if adverse reactions known to occur with clobazam are experienced when coadministered with EPIDIOLEX.³

IMPORTANT SAFETY INFORMATION

WARNINGS & PRECAUTIONS

Hepatocellular Injury:

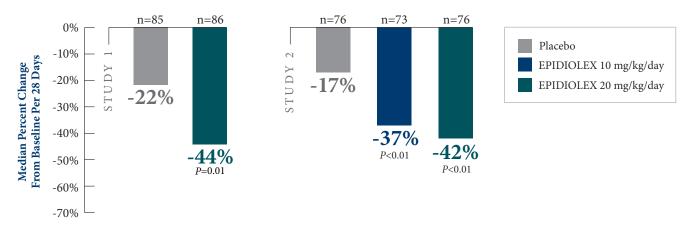
EPIDIOLEX can cause dose-related transaminase elevations. Concomitant use of valproate and elevated transaminase levels at baseline increase this risk. Transaminase and bilirubin levels should be obtained prior to starting treatment, at one, three, and six months after initiation of treatment, and periodically thereafter, or as clinically indicated. Resolution of transaminase elevations occurred with discontinuation of EPIDIOLEX, reduction of EPIDIOLEX and/or concomitant valproate, or without dose reduction. For patients with elevated transaminase levels, consider dose reduction or discontinuation of EPIDIOLEX or concomitant medications known to affect the liver (e.g., valproate or clobazam). Dose adjustment and slower dose titration is recommended in patients with moderate or severe hepatic impairment. Consider not initiating EPIDIOLEX in patients with evidence of significant liver injury.

AUC=area under the curve; $\rm C_{max}=maximum$ serum concentration; N-CLB=N-desmethylclobazam; 7-OH-CBD=7-hydroxycannabidiol.



EPIDIOLEX significantly reduced drop seizure frequency in highly refractory patients with LGS³

Reduction in monthly frequency of drop seizures^{3*}

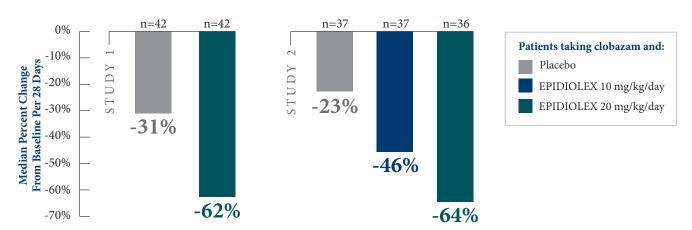


^{*}Results from the 14-week treatment period. Drop seizures were defined as atonic, tonic, or tonic-clonic seizures that led to or could have led to a fall or injury.3.6.7

In the EPIDIOLEX clinical studies for LGS, 49% of patients were taking concomitant clobazam³

A prespecified exploratory analysis evaluated the effect of EPIDIOLEX on drop seizure reduction in the subgroup of patients receiving clobazam⁸

Among patients taking clobazam, those also taking EPIDIOLEX experienced a greater reduction in drop seizures than with placebo⁸



IMPORTANT SAFETY INFORMATION (cont'd)

WARNINGS AND PRECAUTIONS (cont'd)

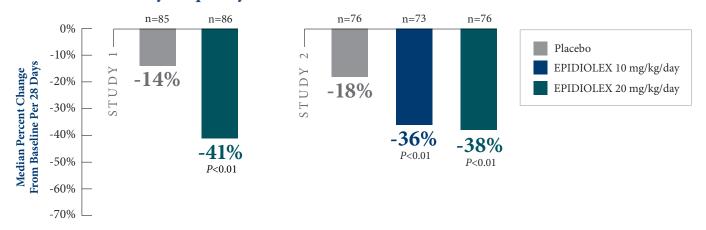
Somnolence and Sedation:

EPIDIOLEX can cause somnolence and sedation that generally occurs early in treatment and may diminish over time; these effects occur more commonly in patients using clobazam and may be potentiated by other CNS depressants.



EPIDIOLEX significantly reduced total seizures in patients with LGS³

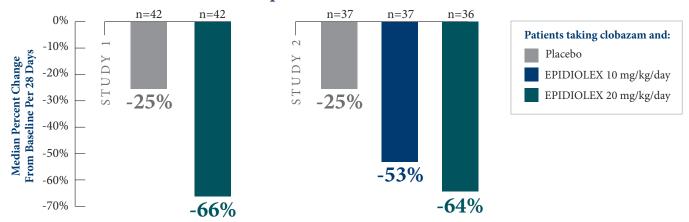
Reduction in monthly frequency of total seizures^{3*}



^{*}Results from the 14-week treatment period. Total seizures included drop and non-drop seizures. 3,6,7

A post-hoc exploratory analysis evaluated the effect of EPIDIOLEX on total seizure reduction in the subgroup of patients receiving clobazam⁸

Among patients taking clobazam, those also taking EPIDIOLEX experienced a greater reduction in total seizures than with placebo⁸



For patients with LGS and Dravet syndrome, the recommended daily dosage of EPIDIOLEX is **10 mg/kg/day** (5 mg/kg twice daily), with a maximum maintenance dosage of **20 mg/kg/day** (10 mg/kg twice daily)^{3*}

IMPORTANT SAFETY INFORMATION (cont'd)

WARNINGS AND PRECAUTIONS (cont'd)

Suicidal Behavior and Ideation:

Antiepileptic drugs (AEDs), including EPIDIOLEX, increase the risk of suicidal thoughts or behavior. Inform patients, caregivers, and families of the risk and advise to monitor and report any signs of depression, suicidal thoughts or behavior, or unusual changes in mood or behavior.

If these symptoms occur, consider if they are related to the AED or the underlying illness.

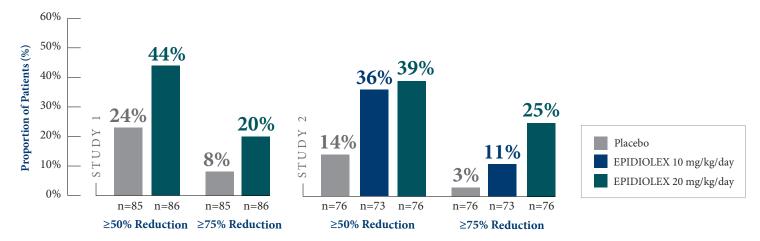
Please see Important Safety Information throughout and on page 11 and the full <u>Prescribing Information</u>.



^{*}Administration of the 20 mg/kg/day dosage resulted in somewhat greater reductions in seizure rates than the recommended maintenance dosage of 10 mg/kg/day, but with an increase in adverse reactions. Patients with moderate to severe hepatic impairment require a dose adjustment.

EPIDIOLEX cut seizure frequency by ≥50% and ≥75% in more patients than placebo in the LGS trials⁸

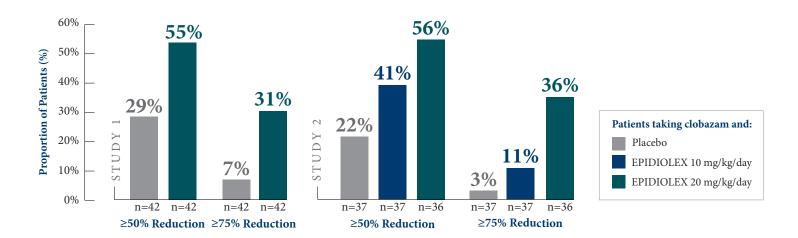
Responder rates (≥50% and ≥75% reductions in drop seizures from baseline)8*



^{*}Results from the 14-week treatment period. ≥50% responder rate, defined as the proportion of patients with ≥50% reduction in primary seizure type frequency during the treatment period. ≥75% responder rate, defined as the proportion of patients with ≥75% reduction in primary seizure type frequency during the treatment period.

A prespecified exploratory analysis evaluated the effect of EPIDIOLEX on seizure frequency in the subgroup of patients receiving clobazam⁸

Among patients taking clobazam, more experienced ≥50% and ≥75% reductions in seizure frequency with EPIDIOLEX than with placebo⁸



IMPORTANT SAFETY INFORMATION (cont'd)

WARNINGS AND PRECAUTIONS (cont'd)

Withdrawal of Antiepileptic Drugs:

As with most AEDs, EPIDIOLEX should generally be withdrawn gradually because of the risk of increased seizure frequency and status epilepticus.





The safety profile of EPIDIOLEX was evaluated in an expansive clinical trial program³

Most common adverse events (≥10% and greater than placebo) observed during the 14-Week treatment period of Phase 3 controlled trials for LGS and Dravet syndrome (%)³

	Placebo	EPIDIOLEX	EPIDIOLEX
	(n=227)	10 mg/kg/day (n=75)	20 mg/kg/day (n=238)
Hepatic Disorders Transaminases elevated	3	8	16
Gastrointestinal Disorders Decreased appetite Diarrhea	5	16	22
	9	9	20
Nervous System Disorders Somnolence Fatigue, malaise, asthenia Insomnia, sleep disorder, poor-quality sleep	8	23	25
	4	11	12
	4	11	5
Infections Infection, all	31	41	40
Other Rash	3	7	13

EPIDIOLEX was found to have a consistent safety profile across LGS and Dravet syndrome³



Hematologic abnormalities, decreased weight, and increased creatinine levels were also observed.³



In the LGS and Dravet syndrome studies, the rate of discontinuation for any adverse reaction was 2.7% for patients taking EPIDIOLEX 10 mg/kg/day, 11.8% for patients taking EPIDIOLEX 20 mg/kg/day, and 1.3% for patients on placebo.³



The most frequent causes of discontinuation were transaminase elevations, somnolence, sedation, and lethargy.³

Pneumonia was observed more frequently with concomitant use of EPIDIOLEX and clobazam³



Important considerations for patients taking EPIDIOLEX and clobazam

Warnings & precautions: Somnolence and sedation

Combined incidence of somnolence and sedation (including lethargy)³

LGS & Dravet syndrome clinical trials		
OVERALI	Placebo overall	11%
OVERALL	EPIDIOLEX overall	32%
BY DOSE	EPIDIOLEX 10 mg/kg/day	27%
	EPIDIOLEX 20 mg/kg/day	34%
USE OF CLOBAZAM	EPIDIOLEX without clobazam	16%
	EPIDIOLEX with concomitant clobazam	46%

- In general, these effects were more common early in treatment and may diminish with continued treatment³
- Other CNS depressants, including alcohol, could potentiate the somnolence and sedation effect of EPIDIOLEX³
- Monitor for somnolence and sedation and advise patients not to drive or operate machinery until they have gained sufficient experience on EPIDIOLEX³

In clinical trials, clobazam was among the most commonly used concomitant AEDs³ Clobazam

EPIDIOLEX produces a 3-fold increase in plasma concentrations of the active metabolite of clobazam, with no effect on clobazam levels. This may increase the risk of clobazam-related adverse reactions, including somnolence, sedation, pneumonia, and liver enzyme elevations.³



Consider a reduction of dosage of clobazam if known clobazam adverse reactions occur.³



Rapid withdrawal of most AEDs can lead to increased seizure frequency and status epilepticus.³

22% of patients in the LGS studies taking concomitant clobazam with either dose of EPIDIOLEX reported a dose reduction of clobazam during the trial9



Ongoing monitoring during treatment is recommended³

Hepatocellular injury

EPIDIOLEX can cause dose-related transaminase elevations.³

In controlled studies, the incidence of ALT elevations (>3x the upper limit of normal [ULN]) was 13% in patients with LGS and Dravet syndrome treated with 10 and 20 mg/kg/day of EPIDIOLEX, 12% in patients with TSC treated with 25 mg/kg/day of EPIDIOLEX, and 1% with placebo. Less than 1% of EPIDIOLEX-treated patients had ALT or AST 20x the ULN.³

• Concomitant use of valproate and elevated transaminase levels at baseline increase this risk³

Incidence of ALT elevations >3x ULN in patients treated with EPIDIOLEX³

	EPIDIOLEX + clobazam and valproate	EPIDIOLEX + clobazam (without valproate)	EPIDIOLEX (without clobazam or valproate)
LGS & Dravet syndrome clinical trials	30%	4%	3%

Obtain serum transaminases (ALT and AST) and total bilirubin levels³



Consider more frequent monitoring of serum transaminases and bilirubin in patients who are taking valproate or who have elevated liver enzymes at baseline³



Monitor within 1 month following changes in EPIDIOLEX dosage and addition of or changes in medications that are known to impact the liver.³

Consider discontinuation or dose reduction of EPIDIOLEX or concomitant medications known to affect the liver (eg, valproate or clobazam) if liver enzyme elevations occur (transaminase levels >3x the ULN and bilirubin levels >2x the ULN, or sustained transaminase elevations >5x the ULN).³

See important dosing considerations for patients with hepatic impairment on page 10.

IMPORTANT SAFETY INFORMATION (CONT'D)

ADVERSE REACTIONS:

The most common adverse reactions in patients receiving EPIDIOLEX (≥10% and greater than placebo) include transaminase elevations; somnolence; decreased appetite; diarrhea; pyrexia; vomiting; fatigue, malaise, and asthenia; rash; insomnia, sleep disorder and poor-quality sleep; and infections. Hematologic abnormalities were also observed.

 $\label{eq:all-alanine} ALT\mbox{=} a \mbox{minotransferase}; AST\mbox{=} a \mbox{spartate aminotransferase}.$



Additional considerations for patients taking EPIDIOLEX and other therapies

Drug interactions

- Concomitant use of EPIDIOLEX and valproate increases the incidence of liver enzyme elevations³
- EPIDIOLEX may affect exposure to CYP2C19 substrates (eg, clobazam, diazepam, stiripentol) or other substrates. Dosage adjustment of EPIDIOLEX or other concomitant medications may be necessary³
- Increases in exposure of sensitive CYP1A2 substrates (eg, caffeine, theophylline, or tizanidine) may be observed when coadministered with EPIDIOLEX³

Effect on EPIDIOLEX3

Dose adjustment based on tolerability³

therapeutic levels; recommend lower starting dose of everolimus

Strong inducer of CYP3A4 and CYP2C19	Consider up to a 2-fold dose increase of EPIDIOLEX
EPIDIOLEX effect on other substrates ³	
Substrates of UGT1A9, UGT2B7, CYP1A2, CYP2C8, CYP2C9, and CYP2C19	Consider dose reduction of the substrate
Substrates of CYP2B6	Consider adjusting dosage of the substrate
Orally administered substrates of P-on	Consider dose reduction of the substrate and monitor

IMPORTANT SAFETY INFORMATION (CONT'D)

Pregnancy:

EPIDIOLEX should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus. Encourage women who are taking EPIDIOLEX during pregnancy to enroll in the North American Antiepileptic Drug (NAAED) Pregnancy Registry.

Drug Interactions:

Strong inducers of CYP3A4 and CYP2C19 may affect EPIDIOLEX exposure. EPIDIOLEX may affect exposure to CYP2C19 substrates (e.g., clobazam, diazepam, stiripentol), orally administered P-gp substrates, or other substrates (see full Prescribing Information). Consider dose reduction of orally administered everolimus, with appropriate therapeutic drug monitoring, when everolimus is combined with EPIDIOLEX. A lower starting dose of everolimus is recommended when added to EPIDIOLEX therapy. Concomitant use of EPIDIOLEX and valproate increases the incidence of liver enzyme elevations. Pneumonia was observed more frequently with concomitant use of EPIDIOLEX and clobazam. Dosage adjustment of EPIDIOLEX or other concomitant medications may be necessary.



EPIDIOLEX offers flexible dosing for tolerability and response optimization³

	Recommended starting dosage	Dosage increase*	Recommended maintenance dosage
LGS	Week 1: 5 mg/kg/day (2.5 mg/kg twice daily)	Weekly increments, as tolerated, of 5 mg/kg/day (2.5 mg/kg twice daily)	10 to 20 mg/kg/day † (5 to 10 mg/kg twice daily)

EPIDIOLEX can cause dose-related elevations of liver transaminases. Because of the risk of hepatocellular injury, obtain serum transaminases (ALT and AST) and total bilirubin levels in all patients prior to starting treatment with EPIDIOLEX and periodically thereafter.³

EPIDIOLEX dose adjustments in patients with hepatic impairment

- Dose adjustment and slower dose titration are recommended in patients with moderate or severe hepatic impairment³
- Consider not initiating EPIDIOLEX in patients with evidence of significant liver injury³
- Dose adjustments are not required in patients with mild hepatic impairment³

Dosing in patients with hepatic impairment³

	Starting dosage	LGS Maintenance dosage range
Moderate hepatic impairment (1/2 recommended standard dosing)	2.5 mg/kg/day (1.25 mg/kg twice daily)	5 to 10 mg/kg/day (2.5 to 5 mg/kg twice daily)
Severe hepatic impairment (1/5 recommended standard dosing)	1 mg/kg/day (0.5 mg/kg twice daily)	2 to 4 mg/kg/day (1 to 2 mg/kg twice daily)

INDICATIONS:

EPIDIOLEX (cannabidiol) oral solution is indicated for the treatment of seizures associated with Lennox-Gastaut syndrome (LGS), Dravet syndrome (DS), or tuberous sclerosis complex (TSC) in patients 1 year of age and older.



^{*}For patients in whom a more rapid titration is warranted, the dosage may be increased no more frequently than every other day.

[†]For patients with LGS or Dravet syndrome, administration of the 20 mg/kg/day dosage resulted in somewhat greater reductions in seizure rates than the recommended maintenance dosage of 10 mg/kg/day, but with an increase in adverse reactions. Increase dose from 10 mg/kg/day if tolerated and required.

Important Safety Information & Indications

CONTRAINDICATION: HYPERSENSITIVITY

EPIDIOLEX (cannabidiol) oral solution is contraindicated in patients with a history of hypersensitivity to cannabidiol or any ingredients in the product.

WARNINGS & PRECAUTIONS

Hepatocellular Injury:

EPIDIOLEX can cause dose-related transaminase elevations. Concomitant use of valproate and elevated transaminase levels at baseline increase this risk. Transaminase and bilirubin levels should be obtained prior to starting treatment, at one, three, and six months after initiation of treatment, and periodically thereafter, or as clinically indicated. Resolution of transaminase elevations occurred with discontinuation of EPIDIOLEX, reduction of EPIDIOLEX and/or concomitant valproate, or without dose reduction. For patients with elevated transaminase levels, consider dose reduction or discontinuation of EPIDIOLEX or concomitant medications known to affect the liver (e.g., valproate or clobazam). Dose adjustment and slower dose titration is recommended in patients with moderate or severe hepatic impairment. Consider not initiating EPIDIOLEX in patients with evidence of significant liver injury.

Somnolence and Sedation:

EPIDIOLEX can cause somnolence and sedation that generally occurs early in treatment and may diminish over time; these effects occur more commonly in patients using clobazam and may be potentiated by other CNS depressants.

Suicidal Behavior and Ideation:

Antiepileptic drugs (AEDs), including EPIDIOLEX, increase the risk of suicidal thoughts or behavior. Inform patients, caregivers, and families of the risk and advise to monitor and report any signs of depression, suicidal thoughts or behavior, or unusual changes in mood or behavior. If these symptoms occur, consider if they are related to the AED or the underlying illness.

Withdrawal of Antiepileptic Drugs:

As with most AEDs, EPIDIOLEX should generally be withdrawn gradually because of the risk of increased seizure frequency and status epilepticus.

ADVERSE REACTIONS:

The most common adverse reactions in patients receiving EPIDIOLEX (≥10% and greater than placebo) include transaminase elevations; somnolence; decreased appetite; diarrhea; pyrexia; vomiting; fatigue, malaise, and asthenia; rash; insomnia, sleep disorder and poor-quality sleep; and infections. Hematologic abnormalities were also observed.

Pregnancy:

EPIDIOLEX should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus. Encourage women who are taking EPIDIOLEX during pregnancy to enroll in the North American Antiepileptic Drug (NAAED) Pregnancy Registry.

DRUG INTERACTIONS:

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INDICATIONS:

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Please refer to the EPIDIOLEX full <u>Prescribing</u> <u>Information</u> for additional important information.



Clinical review:

Concomitant use of EPIDIOLEX® (cannabidiol) and clobazam in the treatment of Lennox-Gastaut syndrome (LGS)



There is a bidirectional pharmacokinetic interaction between EPIDIOLEX and clobazam in which each compound selectively increases exposure to the major active metabolite of the other without affecting parent drug levels.³



EPIDIOLEX significantly reduced seizure frequency in highly refractory patients with LGS³

- 49% of patients studied were on concomitant clobazam³
- In a prespecified exploratory analysis that evaluated the effect of EPIDIOLEX in the subgroup of patients with LGS taking clobazam, those also taking EPIDIOLEX experienced a greater reduction in seizure frequency than with placebo⁸



Incidence of ALT elevations >3x ULN in patients treated with EPIDIOLEX in combination with clobazam (without valproate) was 4% and 3% without clobazam or valproate.³



EPIDIOLEX can cause somnolence and sedation that generally occurs early in treatment and may diminish over time; these effects occur more commonly in patients using clobazam and may be potentiated by other CNS depressants.³

• 22% of patients in the LGS studies taking concomitant clobazam with either dose of EPIDIOLEX reported a dose reduction of clobazam during the trial⁹

See how your patients can benefit from combination therapy at EPIDIOLEXhcp.com

Adverse reactions:

The most common adverse reactions in patients receiving EPIDIOLEX (≥10% and greater than placebo) include³:

- Transaminase elevations
- Somnolence
- Decreased appetite
- Diarrhea
- Pyrexia

- Vomiting
- Fatigue, malaise, and asthenia
- Rash
- Insomnia, sleep disorder, and poor-quality sleep
- Infections

Hematologic abnormalities, decreased weight, and increased creatinine levels were also observed.³

References: 1. Cross JH, Auvin S, Falip M, Striano P, Arzimanoglou A. Expert opinion on the management of Lennox-Gastaut syndrome: treatment algorithms and practical considerations. *Front Neurol.* 2017;8:505. doi: 10.3389/fneur.2017.00505. 2. Piña-Garza JE, Boyce D, Tworek DM, et al. The refractory epilepsy screening tool for Lennox-Gastaut syndrome (REST-LGS). *Epilepsy Behav.* 2019;90:148-153. 3. EPIDIOLEX [package insert]. Carlsbad, CA: Greenwich Biosciences, LLC.; 2022. 4. Onfi [package insert]. Deerfield, IL: Lundbeck; 2021. 5. Rana RR, Gray RA, Whalley BJ. Pharmacodynamic interaction between cannabidiol (CBD) and clobazam (CLB) in a mouse model of acute generalized seizure. Presented at: The American Epilepsy Society Annual Meeting; December 6-10, 2019; Baltimore, MD. 6. Thiele EA, Marsh ED, French JA, et al. Cannabidiol in patients with seizures associated with Lennox-Gastaut syndrome (GWPCARE4): a randomised, double-blind, placebo-controlled phase 3 trial. *Lancet.* 2018;391(10125):1085-1096. 7. Devinsky O, Patel AD, Cross JH, et al. Effect of cannabidiol on drop seizures in the Lennox-Gastaut syndrome. *N Engl J Med.* 2018;378(20):1888-1897. 8. Gunning B, Mazurkiewicz-Bełdzińska M, Chin RFM, et al. Cannabidiol in conjunction with clobazam: analysis of four randomized controlled trials. *Acta Neurol Scand.* 2021;143(2):154-163. 9. Data on file. Greenwich Biosciences, Inc.

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