

# LEVETIRACETAM- levetiracetam tablet, film coated

## Cardinal Health 107, LLC

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### HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use LEVETIRACETAM TABLETS safely and effectively. See full prescribing information for LEVETIRACETAM TABLETS.

### LEVETIRACETAM tablets, for oral use

#### Initial U.S. Approval: 1999

#### INDICATIONS AND USAGE

Levetiracetam tablets are indicated for adjunctive therapy in the treatment of:

- Partial onset seizures in patients one month of age and older with epilepsy ( 1.1)
- Myoclonic seizures in patients 12 years of age and older with juvenile myoclonic epilepsy ( 1.2)
- Primary generalized tonic-clonic seizures in patients 6 years of age and older with idiopathic generalized epilepsy ( 1.3)

#### DOSAGE AND ADMINISTRATION

- Use the oral solution for pediatric patients with body weight  $\leq$  20 kg ( 2.1)
- For pediatric patients, use weight-based dosing for the oral solution with a calibrated measuring device (not a household teaspoon or tablespoon) ( 2.1)

#### Partial Onset Seizures

- 1 Month to < 6 Months: 7 mg/kg twice daily; increase by 7 mg/kg twice daily every 2 weeks to recommended dose of 21 mg/kg twice daily ( 2.2)
- 6 Months to < 4 Years: 10 mg/kg twice daily; increase by 10 mg/kg twice daily every 2 weeks to recommended dose of 25 mg/kg twice daily ( 2.2)
- 4 Years to < 16 Years: 10 mg/kg twice daily; increase by 10 mg/kg twice daily every 2 weeks to recommended dose of 30 mg/kg twice daily ( 2.2)
- Adults 16 Years and Older: 500 mg twice daily; increase by 500 mg twice daily every 2 weeks to a recommended dose of 1500 mg twice daily ( 2.2)

#### Myoclonic Seizures in Adults and Pediatric Patients 12 Years and Older

- 500 mg twice daily; increase by 500 mg twice daily every 2 weeks to recommended dose of 1500 mg twice daily ( 2.3)

#### Primary Generalized Tonic-Clonic Seizures

- 6 Years to < 16 Years: 10 mg/kg twice daily, increase in increments of 10 mg/kg twice daily every 2 weeks to recommended dose of 30 mg/kg twice daily ( 2.4)
- Adults 16 Years and Older: 500 mg twice daily, increase by 500 mg twice daily every 2 weeks to recommended dose of 1500 mg twice daily ( 2.4)

#### Adult Patients with Impaired Renal Function

- Dose adjustment is recommended, based on the patient's estimated creatinine clearance ( 2.5, 8.6)

#### DOSAGE FORMS AND STRENGTHS

- 250 mg, 500 mg, 750 mg and 1000 mg film-coated, scored tablets ( 3)

#### CONTRAINDICATIONS

- None ( 4)

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## WARNINGS AND PRECAUTIONS

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- Behavioral abnormalities including psychotic symptoms, suicidal ideation, irritability, and aggressive behavior have been observed; monitor patients for psychiatric signs and symptoms ( 5.1)
- Suicidal Behavior and Ideation: Monitor patients for new or worsening depression, suicidal thoughts/behavior, and/or unusual changes in mood or behavior ( 5.2)
- Monitor for somnolence and fatigue and advise patients not to drive or operate machinery until they have gained sufficient experience on levetiracetam tablets ( 5.3)
- Withdrawal Seizures: Levetiracetam tablets must be gradually withdrawn ( 5.6)

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## ADVERSE REACTIONS

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Most common adverse reactions (incidence  $\geq$  5% more than placebo) include:

- Adult patients: somnolence, asthenia, infection and dizziness ( 6.1)
- Pediatric patients: fatigue, aggression, nasal congestion, decreased appetite, and irritability ( 6.1)

**To report SUSPECTED ADVERSE REACTIONS, contact Mylan Pharmaceuticals Inc. at 1-877-446-3679 (1-877-4-INFO-RX) or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch).**

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## USE IN SPECIFIC POPULATIONS

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Pregnancy: Plasma levels of levetiracetam may be decreased and therefore need to be monitored closely during pregnancy. Based on animal data, may cause fetal harm ( 5.9, 8.1)

**See 17 for PATIENT COUNSELING INFORMATION and Medication Guide.**

**Revised: 3/2021**

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## **FULL PRESCRIBING INFORMATION**

### **1 INDICATIONS AND USAGE**

#### **1.1 Partial Onset Seizures**

Levetiracetam tablets are indicated as adjunctive therapy in the treatment of partial onset seizures in adults and children 1 month of age and older with epilepsy.

#### **1.2 Myoclonic Seizures in Patients with Juvenile Myoclonic Epilepsy**

Levetiracetam tablets are indicated as adjunctive therapy in the treatment of myoclonic seizures in adults and adolescents 12 years of age and older with juvenile myoclonic epilepsy.

#### **1.3 Primary Generalized Tonic-Clonic Seizures**

Levetiracetam tablets are indicated as adjunctive therapy in the treatment of primary generalized tonic-clonic seizures in adults and children 6 years of age and older with

idiopathic generalized epilepsy.

## **2 DOSAGE AND ADMINISTRATION**

### **2.1 Important Administration Instructions**

Levetiracetam tablets are given orally with or without food. The levetiracetam dosing regimen depends on the indication, age group, dosage form (tablets or oral solution), and renal function.

Prescribe the oral solution for pediatric patients with body weight  $\leq 20$  kg. Prescribe the oral solution or tablets for pediatric patients with body weight above 20 kg.

When using the oral solution in pediatric patients, dosing is weight-based (mg per kg) using a calibrated measuring device (not a household teaspoon or tablespoon).

Levetiracetam tablets should be swallowed whole. Levetiracetam tablets should not be chewed or crushed.

### **2.2 Dosing for Partial Onset Seizures**

#### ***Adults 16 Years and Older***

Initiate treatment with a daily dose of 1000 mg/day, given as twice-daily dosing (500 mg twice daily). Additional dosing increments may be given (1000 mg/day additional every 2 weeks) to a maximum recommended daily dose of 3000 mg. There is no evidence that doses greater than 3000 mg/day confer additional benefit.

#### ***Pediatric Patients***

##### ***1 Month to < 6 Months***

Initiate treatment with a daily dose of 14 mg/kg in 2 divided doses (7 mg/kg twice daily). Increase the daily dose every 2 weeks by increments of 14 mg/kg to the recommended daily dose of 42 mg/kg (21 mg/kg twice daily). In the clinical trial, the mean daily dose was 35 mg/kg in this age group. The effectiveness of lower doses has not been studied.

##### ***6 Months to < 4 Years***

Initiate treatment with a daily dose of 20 mg/kg in 2 divided doses (10 mg/kg twice daily). Increase the daily dose in 2 weeks by an increment of 20 mg/kg to the recommended daily dose of 50 mg/kg (25 mg/kg twice daily). If a patient cannot tolerate a daily dose of 50 mg/kg, the daily dose may be reduced. In the clinical trial, the mean daily dose was 47 mg/kg in this age group.

##### ***4 Years to < 16 Years***

Initiate treatment with a daily dose of 20 mg/kg in 2 divided doses (10 mg/kg twice daily). Increase the daily dose every 2 weeks by increments of 20 mg/kg to the recommended daily dose of 60 mg/kg (30 mg/kg twice daily). If a patient cannot tolerate a daily dose of 60 mg/kg, the daily dose may be reduced. In the clinical trial, the mean daily dose was 44 mg/kg. The maximum daily dose was 3000 mg/day.

For levetiracetam tablets dosing in pediatric patients weighing 20 kg to 40 kg, initiate treatment with a daily dose of 500 mg given as twice daily dosing (250 mg twice daily). Increase the daily dose every 2 weeks by increments of 500 mg to a maximum recommended daily dose of 1500 mg (750 mg twice daily).

For levetiracetam tablets dosing in pediatric patients weighing more than 40 kg, initiate treatment with a daily dose of 1000 mg/day given as twice daily dosing (500 mg twice daily). Increase the daily dose every 2 weeks by increments of 1000 mg/day to a maximum recommended daily dose of 3000 mg (1500 mg twice daily).

### ***Levetiracetam Oral Solution Weight-Based Dosing Calculation for Pediatric Patients***

The following calculation should be used to determine the appropriate daily dose of oral solution for pediatric patients:

$$\text{Total daily dose (mL/day)} = \frac{\text{Daily dose (mg/kg/day)} \times \text{patient weight (kg)}}{100 \text{ mg/mL}}$$

## **2.3 Dosing for Myoclonic Seizures in Patients 12 Years of Age and Older with Juvenile Myoclonic Epilepsy**

Initiate treatment with a dose of 1000 mg/day, given as twice-daily dosing (500 mg twice daily). Increase the dosage by 1000 mg/day every 2 weeks to the recommended daily dose of 3000 mg. The effectiveness of doses lower than 3000 mg/day has not been studied.

## **2.4 Dosing for Primary Generalized Tonic-Clonic Seizures**

### ***Adults 16 Years and Older***

Initiate treatment with a dose of 1000 mg/day, given as twice-daily dosing (500 mg twice daily). Increase dosage by 1000 mg/day every 2 weeks to the recommended daily dose of 3000 mg. The effectiveness of doses lower than 3000 mg/day has not been adequately studied.

### ***Pediatric Patients Ages 6 to < 16 Years***

Initiate treatment with a daily dose of 20 mg/kg in 2 divided doses (10 mg/kg twice daily). Increase the daily dose every 2 weeks by increments of 20 mg/kg to the recommended daily dose of 60 mg/kg (30 mg/kg twice daily). The effectiveness of doses lower than 60 mg/kg/day has not been adequately studied. Patients with body weight  $\leq$  20 kg should be dosed with oral solution. Patients with body weight above 20 kg can be dosed with either tablets or oral solution [see *Dosage and Administration (2.1)*]. Only whole tablets should be administered.

## **2.5 Dosage Adjustments in Adult Patients with Renal Impairment**

Levetiracetam tablets dosing must be individualized according to the patient's renal function status. Recommended dosage adjustments for adults are shown in Table 1. In order to calculate the dose recommended for patients with renal impairment, creatinine clearance adjusted for body surface area must be calculated. To do this an estimate of the patient's creatinine clearance (CL<sub>Cr</sub>) in mL/min must first be calculated using the following formula:

$$\text{CL}_{\text{Cr}} = \frac{[140 - \text{age (years)}] \times \text{weight (kg)}}{72 \times \text{serum creatinine (mg/dL)}} \quad (\times 0.85 \text{ for female patients})$$

Then CL<sub>Cr</sub> is adjusted for body surface area (BSA) as follows:

$$\text{CL}_{\text{Cr}} (\text{mL/min/1.73m}^2) = \frac{\text{CL}_{\text{Cr}} (\text{mL/min})}{\text{BSA subject (m}^2\text{)}} \times 1.73$$

**Table 1: Dosing Adjustment Regimen for Adult Patients with Renal Impairment**

Group	Creatinine Clearance (mL/min/1.73m <sup>2</sup> )	Dosage (mg)	Frequency
Normal	> 80	500 to 1,500	Every 12 hours
Mild	50 to 80	500 to 1,000	Every 12 hours
Moderate	30 to 50	250 to 750	Every 12 hours
Severe	< 30	250 to 500	Every 12 hours
ESRD patients using dialysis	---	500 to 1,000 *	Every 24 hours *

\* Following dialysis, a 250 mg to 500 mg supplemental dose is recommended.

### 3 DOSAGE FORMS AND STRENGTHS

Levetiracetam Tablets, USP are available containing 250 mg, 500 mg, 750 mg or 1000 mg of levetiracetam, USP

- The 250 mg tablets are white, film-coated, round tablets debossed with **M** above the score and **613** below the score on one side of the tablet and blank on the other side.
- The 500 mg tablets are white, film-coated, modified capsule-shaped tablets debossed with **M** to the left of the score and **615** to the right of the score on one side of the tablet and blank on the other side.
- The 750 mg tablets are white, film-coated, modified capsule-shaped tablets debossed with **M** to the left of the score and **617** to the right of the score on one

side of the tablet and blank on the other side.

- The 1000 mg tablets are white, film-coated, modified capsule-shaped tablets debossed with **M** to the left of the score and **619** to the right of the score on one side of the tablet and blank on the other side.

## **4 CONTRAINDICATIONS**

None.

## **5 WARNINGS AND PRECAUTIONS**

### **5.1 Behavioral Abnormalities and Psychotic Symptoms**

Levetiracetam tablets may cause behavioral abnormalities and psychotic symptoms. Patients treated with levetiracetam tablets should be monitored for psychiatric signs and symptoms.

#### ***Behavioral Abnormalities***

In clinical studies, 13% of adult levetiracetam tablets-treated patients and 38% of pediatric levetiracetam tablets-treated patients (4 to 16 years of age) compared to 6% and 19% of adult and pediatric placebo-treated patients, experienced non-psychotic behavioral symptoms (reported as aggression, agitation, anger, anxiety, apathy, depersonalization, depression, emotional lability, hostility, hyperkinesias, irritability, nervousness, neurosis, and personality disorder).

A randomized double-blind, placebo-controlled study was performed to assess the neurocognitive and behavioral effects of levetiracetam tablets as adjunctive therapy in pediatric patients (4 to 16 years of age). The results from an exploratory analysis indicated a worsening in levetiracetam tablets-treated patients on aggressive behavior (one of eight behavior dimensions) as measured in a standardized and systematic way using a validated instrument, the Achenbach Child Behavior Checklist (CBCL/6-18).

In clinical studies in pediatric patients 1 month to < 4 years of age, irritability was reported in 12% of the levetiracetam tablets-treated patients compared to 0% of placebo-treated patients.

In clinical studies, 1.7% of adult levetiracetam tablets-treated patients discontinued treatment due to behavioral adverse reactions, compared to 0.2% of placebo-treated patients. The treatment dose was reduced in 0.8% of adult levetiracetam tablets-treated patients and in 0.5% of placebo-treated patients. Overall, 11% of levetiracetam tablets-treated pediatric patients experienced behavioral symptoms associated with discontinuation or dose reduction, compared to 6% of placebo-treated patients.

#### ***Psychotic Symptoms***

In clinical studies, 1% of levetiracetam tablets-treated adult patients, 2% of levetiracetam tablets-treated pediatric patients 4 to 16 years of age, and 17% of levetiracetam tablets-treated pediatric patients 1 month to < 4 years of age experienced psychotic symptoms, compared to 0.2%, 2%, and 5% in the corresponding age groups treated with placebo. In a controlled study that assessed the neurocognitive and behavioral effects of levetiracetam tablets in pediatric patients 4 to 16 years of age, 1.6% of

levetiracetam tablets-treated patients experienced paranoia, compared to 0% of placebo-treated patients. In the same study, 3.1% of levetiracetam tablets-treated patients experienced confusional state, compared to 0% of placebo-treated patients [see Use in Specific Populations (8.4)] .

In clinical studies, two (0.3%) levetiracetam tablets-treated adult patients were hospitalized and their treatment was discontinued due to psychosis. Both events, reported as psychosis, developed within the first week of treatment and resolved within 1 to 2 weeks following treatment discontinuation. There was no difference between drug and placebo-treated patients in the incidence of the pediatric patients who discontinued treatment due to psychotic and non-psychotic adverse reactions.

## 5.2 Suicidal Behavior and Ideation

Antiepileptic drugs (AEDs), including levetiracetam tablets, increase the risk of suicidal thoughts or behavior in patients taking these drugs for any indication. Patients treated with any AED for any indication should be monitored for the emergence or worsening of depression, suicidal thoughts or behavior, and/or any unusual changes in mood or behavior.

Pooled analyses of 199 placebo-controlled clinical trials (mono- and adjunctive therapy) of 11 different AEDs showed that patients randomized to one of the AEDs had approximately twice the risk (adjusted Relative Risk 1.8, 95% CI:1.2, 2.7) of suicidal thinking or behavior compared to patients randomized to placebo. In these trials, which had a median treatment duration of 12 weeks, the estimated incidence rate of suicidal behavior or ideation among 27,863 AED-treated patients was 0.43%, compared to 0.24% among 16,029 placebo-treated patients, representing an increase of approximately one case of suicidal thinking or behavior for every 530 patients treated. There were four suicides in drug-treated patients in the trials and none in placebo-treated patients, but the number is too small to allow any conclusion about drug effect on suicide.

The increased risk of suicidal thoughts or behavior with AEDs was observed as early as one week after starting drug treatment with AEDs and persisted for the duration of treatment assessed. Because most trials included in the analysis did not extend beyond 24 weeks, the risk of suicidal thoughts or behavior beyond 24 weeks could not be assessed.

The risk of suicidal thoughts or behavior was generally consistent among drugs in the data analyzed. The finding of increased risk with AEDs of varying mechanisms of action and across a range of indications suggests that the risk applies to all AEDs used for any indication. The risk did not vary substantially by age (5 to 100 years) in the clinical trials analyzed. Table 2 shows absolute and relative risk by indication for all evaluated AEDs.

**Table 2: Risk by Indication for Antiepileptic Drugs in the Pooled Analysis**

Indication	Placebo Patients with Events Per 1,000 Patients	Drug Patients with Events Per 1,000 Patients	Relative Risk: Incidence of Events in Drug Patients/Incidence in Placebo Patients	Risk Difference: Additional Drug Patients with Events Per 1,000 Patients
Epilepsy	1.0	3.4	3.5	2.4
Psychiatric	5.7	8.5	1.5	2.9



Other	1.0	1.8	1.9	0.9
Total	2.4	4.3	1.8	1.9

The relative risk for suicidal thoughts or behavior was higher in clinical trials for epilepsy than in clinical trials for psychiatric or other conditions, but the absolute risk differences were similar for the epilepsy and psychiatric indications.

Anyone considering prescribing levetiracetam tablets or any other AED must balance the risk of suicidal thoughts or behaviors with the risk of untreated illness. Epilepsy and many other illnesses for which AEDs are prescribed are themselves associated with morbidity and mortality and an increased risk of suicidal thoughts and behavior. Should suicidal thoughts and behavior emerge during treatment, the prescriber needs to consider whether the emergence of these symptoms in any given patient may be related to the illness being treated.

Patients, their caregivers, and families should be informed that AEDs increase the risk of suicidal thoughts and behavior and should be advised of the need to be alert for the emergence or worsening of the signs and symptoms of depression, any unusual changes in mood or behavior, or the emergence of suicidal thoughts, behavior, or thoughts about self-harm. Behaviors of concern should be reported immediately to healthcare providers.

### **5.3 Somnolence and Fatigue**

Levetiracetam tablets may cause somnolence and fatigue. Patients should be monitored for these signs and symptoms and advised not to drive or operate machinery until they have gained sufficient experience on levetiracetam tablets to gauge whether it adversely affects their ability to drive or operate machinery.

#### ***Somnolence***

In controlled trials of adult patients with epilepsy experiencing partial onset seizures, 15% of levetiracetam tablets-treated patients reported somnolence, compared to 8% of placebo-treated patients. There was no clear dose response up to 3000 mg/day. In a study where there was no titration, about 45% of patients receiving 4000 mg/day reported somnolence. The somnolence was considered serious in 0.3% of levetiracetam tablets-treated patients, compared to 0% in the placebo group. About 3% of levetiracetam tablets-treated patients discontinued treatment due to somnolence, compared to 0.7% of placebo-treated patients. In 1.4% of levetiracetam tablets-treated patients and 0.9% of placebo-treated patients, the dose was reduced, while 0.3% of the levetiracetam tablets-treated patients were hospitalized due to somnolence.

#### ***Asthenia***

In controlled clinical studies of adult patients with epilepsy experiencing partial onset seizures, 15% of levetiracetam tablets-treated patients reported asthenia, compared to 9% of placebo-treated patients. Treatment was discontinued due to asthenia in 0.8% of levetiracetam tablets-treated patients as compared to 0.5% of placebo-treated patients. In 0.5% of levetiracetam tablets-treated patients and in 0.2% of placebo-treated patients, the dose was reduced due to asthenia.

Somnolence and asthenia occurred most frequently within the first 4 weeks of

treatment. In general, the incidences of somnolence and fatigue in the pediatric partial onset seizure studies, and in pediatric and adult myoclonic and primary generalized tonic-clonic seizure studies were comparable to those of the adult partial onset seizure studies.

#### **5.4 Serious Dermatological Reactions**

Serious dermatological reactions, including Stevens-Johnson syndrome (SJS) and toxic epidermal necrolysis (TEN), have been reported in both pediatric and adult patients treated with levetiracetam tablets. The median time of onset is reported to be 14 to 17 days, but cases have been reported at least four months after initiation of treatment. Recurrence of the serious skin reactions following rechallenge with levetiracetam tablets have also been reported. Levetiracetam tablets should be discontinued at the first sign of a rash, unless the rash is clearly not drug-related. If signs or symptoms suggest SJS/TEN, use of this drug should not be resumed and alternative therapy should be considered.

#### **5.5 Coordination Difficulties**

Levetiracetam tablets may cause coordination difficulties.

In controlled clinical studies in adult patients with partial onset seizure studies, 3.4% of adult levetiracetam tablets-treated patients experienced coordination difficulties, (reported as either ataxia, abnormal gait, or incoordination) compared to 1.6% of placebo-treated patients. A total of 0.4% of patients in controlled clinical studies discontinued levetiracetam tablets treatment due to ataxia, compared to 0% of placebo-treated patients. In 0.7% of levetiracetam tablets-treated patients and in 0.2% of placebo-treated patients, the dose was reduced due to coordination difficulties, while one of the levetiracetam tablets-treated patients was hospitalized due to worsening of pre-existing ataxia. These events occurred most frequently within the first 4 weeks of treatment.

Patients should be monitored for these signs and symptoms and advised not to drive or operate machinery until they have gained sufficient experience on levetiracetam tablets to gauge whether it could adversely affect their ability to drive or operate machinery.

#### **5.6 Withdrawal Seizures**

Antiepileptic drugs, including levetiracetam tablets, should be withdrawn gradually to minimize the potential of increased seizure frequency.

#### **5.7 Hematologic Abnormalities**

Levetiracetam tablets can cause hematologic abnormalities. Hematologic abnormalities occurred in clinical trials and included decreases in red blood cell (RBC) counts, hemoglobin, and hematocrit, and increases in eosinophil counts. Decreased white blood cell (WBC) and neutrophil counts also occurred in clinical trials. Cases of agranulocytosis have been reported in the postmarketing setting.

### ***Partial Onset Seizures***

#### ***Adults***

Minor, but statistically significant, decreases compared to placebo in total mean RBC count ( $0.03 \times 10^6/\text{mm}^3$ ), mean hemoglobin (0.09 g/dL), and mean hematocrit (0.38%), were seen in levetiracetam tablets-treated patients in controlled trials.

A total of 3.2% of levetiracetam tablets-treated and 1.8% of placebo-treated patients had at least one possibly significant ( $\leq 2.8 \times 10^9/\text{L}$ ) decreased WBC, and 2.4% of levetiracetam tablets-treated and 1.4% of placebo-treated patients had at least one possibly significant ( $\leq 1 \times 10^9/\text{L}$ ) decreased neutrophil count. Of the levetiracetam tablets-treated patients with a low neutrophil count, all but one rose towards or to baseline with continued treatment. No patient was discontinued secondary to low neutrophil counts.

### ***Pediatric Patients 4 Years to < 16 Years***

Statistically significant decreases in WBC and neutrophil counts were seen in levetiracetam tablets-treated patients as compared to placebo. The mean decreases from baseline in the levetiracetam tablets-treated group were  $-0.4 \times 10^9/\text{L}$  and  $-0.3 \times 10^9/\text{L}$ , respectively, whereas there were small increases in the placebo group. Mean relative lymphocyte counts increased by 1.7% in levetiracetam tablets-treated patients, compared to a decrease of 4% in placebo patients (statistically significant).

In the controlled trial, more levetiracetam tablets-treated patients had a possibly clinically significant abnormally low WBC value (3% of levetiracetam tablets-treated patients vs. 0% of placebo-treated patients), however, there was no apparent difference between treatment groups with respect to neutrophil count (5% of levetiracetam tablets-treated patients vs. 4.2% of placebo-treated patients). No patient was discontinued secondary to low WBC or neutrophil counts.

In the controlled cognitive and neuropsychological safety study, 5 patients (8.6%) in the levetiracetam tablets-treated group and two patients (6.1%) in the placebo-treated group had high eosinophil count values that were possibly clinically significant ( $\geq 10\%$  or  $\geq 0.7 \times 10^9/\text{L}$ ).

### **5.8 Increase in Blood Pressure**

In a randomized, placebo-controlled study in patients 1 month to < 4 years of age, a significantly higher risk of increased diastolic blood pressure was observed in the levetiracetam tablets-treated patients (17%), compared to the placebo-treated patients (2%). There was no overall difference in mean diastolic blood pressure between the treatment groups. This disparity between the levetiracetam tablets and placebo treatment groups was not observed in the studies of older children or in adults.

Monitor patients 1 month to < 4 years of age for increases in diastolic blood pressure.

### **5.9 Seizure Control during Pregnancy**

Physiological changes may gradually decrease plasma levels of levetiracetam throughout pregnancy. This decrease is more pronounced during the third trimester. It is recommended that patients be monitored carefully during pregnancy. Close monitoring should continue through the postpartum period especially if the dose was changed during pregnancy.

## 6 ADVERSE REACTIONS

The following adverse reactions are discussed in more details in other sections of labeling:

- Psychiatric Symptoms *[see Warnings and Precautions (5.1)]*
- Suicidal Behavior and Ideation *[see Warnings and Precautions (5.2)]*
- Somnolence and Fatigue *[see Warnings and Precautions (5.3)]*
- Serious Dermatological Reactions *[see Warnings and Precautions (5.4)]*
- Coordination Difficulties *[see Warnings and Precautions (5.5)]*
- Hematologic Abnormalities *[see Warnings and Precautions (5.7)]*
- Increase in Blood Pressure *[see Warnings and Precautions (5.8)]*

### 6.1 Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

#### ***Partial Onset Seizures***

##### ***Adults***

In controlled clinical studies in adults with partial onset seizures, the most common adverse reactions in patients receiving levetiracetam tablets in combination with other AEDs, for events with rates greater than placebo, were somnolence, asthenia, infection, and dizziness. Of the most common adverse reactions in adults experiencing partial onset seizures, asthenia, somnolence, and dizziness occurred predominantly during the first 4 weeks of treatment with levetiracetam tablets.

Table 3 lists adverse reactions that occurred in at least 1% of adult epilepsy patients receiving levetiracetam tablets in placebo-controlled studies and were numerically more common than in patients treated with placebo. In these studies, either levetiracetam tablets or placebo was added to concurrent AED therapy.

**Table 3: Adverse Reactions in Pooled Placebo-Controlled, Add-On Studies in Adults Experiencing Partial Onset Seizures**

	<b>Levetiracetam Tablets (N = 769) %</b>	<b>Placebo (N = 439) %</b>
Asthenia	15	9
Somnolence	15	8
Headache	14	13
Infection	13	8
Dizziness	9	4
Pain	7	6
Pharyngitis	6	4
Depression	4	2
Nervousness	4	2
Rhinitis	4	3

Anorexia	3	2
Ataxia	3	1
Vertigo	3	1
Amnesia	2	1
Anxiety	2	1
Cough Increased	2	1
Diplopia	2	1
Emotional Lability	2	0
Hostility	2	1
Paresthesia	2	1
Sinusitis	2	1

In controlled adult clinical studies, 15% of patients receiving levetiracetam tablets and 12% receiving placebo either discontinued or had a dose reduction as a result of an adverse reaction. Table 4 lists the most common (> 1%) adverse reactions that resulted in discontinuation or dose reduction and that occurred more frequently in levetiracetam tablets-treated patients than in placebo-treated patients.

**Table 4: Adverse Reactions that Resulted in Discontinuation or Dose Reduction in Placebo-Controlled Studies in Adult Patients Experiencing Partial Onset Seizures**

<b>Adverse Reaction</b>	<b>Levetiracetam Tablets (N = 769) %</b>	<b>Placebo (N = 439) %</b>
Somnolence	4	2
Dizziness	1	0

#### ***Pediatric Patients 4 Years to < 16 Years***

The adverse reaction data presented below was obtained from a pooled analysis of two controlled pediatric clinical studies in pediatric patients 4 to 16 years of age with partial onset seizures. The most common adverse reactions in pediatric patients receiving levetiracetam tablets in combination with other AEDs, for events with rates greater than placebo, were fatigue, aggression, nasal congestion, decreased appetite, and irritability.

Table 5 lists adverse reactions from the pooled pediatric controlled studies (4 to 16 years of age) that occurred in at least 2% of pediatric levetiracetam tablets-treated patients and were numerically more common than in pediatric patients treated with placebo. In these studies, either levetiracetam tablets or placebo was added to concurrent AED therapy.

**Table 5: Adverse Reactions in Pooled Placebo-Controlled, Add-On Studies in Pediatric Patients Ages 4 to 16 Years Experiencing Partial Onset Seizures**

	<b>Levetiracetam Tablets (N = 165) %</b>	<b>Placebo (N = 131) %</b>
Headache	19	15

Nasopharyngitis	15	12
Vomiting	15	12
Somnolence	13	9
Fatigue	11	5
Aggression	10	5
Cough	9	5
Nasal Congestion	9	2
Upper Abdominal Pain	9	8
Decreased Appetite	8	2
Abnormal Behavior	7	4
Dizziness	7	5
Irritability	7	1
Pharyngolaryngeal Pain	7	4
Diarrhea	6	2
Lethargy	6	5
Insomnia	5	3
Agitation	4	1
Anorexia	4	3
Head Injury	4	0
Altered Mood	3	1
Constipation	3	1
Contusion	3	1
Depression	3	1
Fall	3	2
Influenza	3	1
Affect Lability	2	1
Anxiety	2	1
Arthralgia	2	0
Confusional State	2	0
Conjunctivitis	2	0
Ear Pain	2	1
Gastroenteritis	2	0
Joint Sprain	2	1
Mood Swings	2	1
Neck Pain	2	1
Rhinitis	2	0
Sedation	2	1

In the controlled pooled pediatric clinical studies in patients 4 to 16 years of age, 7% of patients receiving levetiracetam tablets and 9% receiving placebo discontinued as a result of an adverse reaction.

### ***Pediatric Patients 1 Month to < 4 Years***

In the 7-day, controlled pediatric clinical study in children 1 month to less than 4 years of age with partial onset seizures, the most common adverse reactions in patients

receiving levetiracetam tablets in combination with other AEDs, for events with rates greater than placebo, were somnolence and irritability. Because of the shorter exposure period, incidences of adverse reactions are expected to be lower than in other pediatric studies in older patients. Therefore, other controlled pediatric data, presented above, should also be considered to apply to this age group.

Table 6 lists adverse reactions that occurred in at least 5% of pediatric epilepsy patients (ages 1 month to < 4 years) treated with levetiracetam tablets in the placebo-controlled study and were numerically more common than in patients treated with placebo. In this study, either levetiracetam tablets or placebo was added to concurrent AED therapy.

**Table 6: Adverse Reactions in a Placebo-Controlled, Add-On Study in Pediatric Patients Ages 1 Month to < 4 Years Experiencing Partial Onset Seizures**

	<b>Levetiracetam Tablets (N = 60) %</b>	<b>Placebo (N = 56) %</b>
Somnolence	13	2
Irritability	12	0

In the 7-day controlled pediatric clinical study in patients 1 month to < 4 years of age, 3% of patients receiving levetiracetam tablets and 2% receiving placebo either discontinued or had a dose reduction as a result of an adverse reaction. There was no adverse reaction that resulted in discontinuation for more than one patient.

### ***Myoclonic Seizures***

Although the pattern of adverse reactions in this study seems somewhat different from that seen in patients with partial seizures, this is likely due to the much smaller number of patients in this study compared to partial seizure studies. The adverse reaction pattern for patients with JME is expected to be essentially the same as for patients with partial seizures.

In the controlled clinical study in patients 12 years of age and older with myoclonic seizures, the most common adverse reactions in patients receiving levetiracetam tablets in combination with other AEDs, for events with rates greater than placebo, were somnolence, neck pain, and pharyngitis.

Table 7 lists adverse reactions that occurred in at least 5% of juvenile myoclonic epilepsy patients experiencing myoclonic seizures treated with levetiracetam tablets and were numerically more common than in patients treated with placebo. In this study, either levetiracetam tablets or placebo was added to concurrent AED therapy.

**Table 7: Adverse Reactions in a Placebo-Controlled, Add-On Study in Patients 12 Years of Age and Older with Myoclonic Seizures**

	<b>Levetiracetam Tablets (N = 60) %</b>	<b>Placebo (N = 60) %</b>
Somnolence	12	2

Neck pain	8	2
Pharyngitis	7	0
Depression	5	2
Influenza	5	2
Vertigo	5	3

In the placebo-controlled study, 8% of patients receiving levetiracetam tablets and 2% receiving placebo either discontinued or had a dose reduction as a result of an adverse reaction. The adverse reactions that led to discontinuation or dose reduction and that occurred more frequently in levetiracetam tablets-treated patients than in placebo-treated patients are presented in Table 8.

**Table 8: Adverse Reactions that Resulted in Discontinuation or Dose Reduction in a Placebo-Controlled Study in Patients with Juvenile Myoclonic Epilepsy**

<b>Adverse Reaction</b>	<b>Levetiracetam Tablets (N = 60) %</b>	<b>Placebo (N = 60) %</b>
Anxiety	3	2
Depressed mood	2	0
Depression	2	0
Diplopia	2	0
Hypersomnia	2	0
Insomnia	2	0
Irritability	2	0
Nervousness	2	0
Somnolence	2	0

### ***Primary Generalized Tonic-Clonic Seizures***

Although the pattern of adverse reactions in this study seems somewhat different from that seen in patients with partial seizures, this is likely due to the much smaller number of patients in this study compared to partial seizure studies. The adverse reaction pattern for patients with primary generalized tonic-clonic (PGTC) seizures is expected to be essentially the same as for patients with partial seizures.

In the controlled clinical study that included patients 4 years of age and older with PGTC seizures, the most common adverse reaction in patients receiving levetiracetam tablets in combination with other AEDs, for events with rates greater than placebo, was nasopharyngitis.

Table 9 lists adverse reactions that occurred in at least 5% of idiopathic generalized epilepsy patients experiencing PGTC seizures treated with levetiracetam tablets and were numerically more common than in patients treated with placebo. In this study, either levetiracetam tablets or placebo was added to concurrent AED therapy.

**Table 9: Adverse Reactions in a Placebo-Controlled, Add-On Study in Patients 4 Years of Age and Older with PGTC Seizures**



	<b>Levetiracetam Tablets (N = 79) %</b>	<b>Placebo (N = 84) %</b>
Nasopharyngitis	14	5
Fatigue	10	8
Diarrhea	8	7
Irritability	6	2
Mood swings	5	1

In the placebo-controlled study, 5% of patients receiving levetiracetam tablets and 8% receiving placebo either discontinued or had a dose reduction during the treatment period as a result of an adverse reaction.

This study was too small to adequately characterize the adverse reactions that could be expected to result in discontinuation of treatment in this population. It is expected that the adverse reactions that would lead to discontinuation in this population would be similar to those resulting in discontinuation in other epilepsy trials (see tables 4 and 8).

In addition, the following adverse reactions were seen in other controlled adult studies of levetiracetam tablets: balance disorder, disturbance in attention, eczema, memory impairment, myalgia, and blurred vision.

### ***Comparison of Gender, Age and Race***

The overall adverse reaction profile of levetiracetam tablets were similar between females and males. There are insufficient data to support a statement regarding the distribution of adverse reactions by age and race.

## **6.2 Postmarketing Experience**

The following adverse reactions have been identified during postapproval use of levetiracetam tablets. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

The following adverse reactions have been reported in patients receiving marketed levetiracetam tablets worldwide. The listing is alphabetized: abnormal liver function test, acute kidney injury, choreoathetosis, drug reaction with eosinophilia and systemic symptoms (DRESS), dyskinesia, erythema multiforme, hepatic failure, hepatitis, hyponatremia, muscular weakness, pancreatitis, pancytopenia (with bone marrow suppression identified in some of these cases), panic attack, thrombocytopenia, and weight loss. Alopecia has been reported with levetiracetam tablets use; recovery was observed in majority of cases where levetiracetam tablets were discontinued.

## **8 USE IN SPECIFIC POPULATIONS**

### **8.1 Pregnancy**

Levetiracetam blood levels may decrease during pregnancy [see *Warnings and Precautions* (5.9)].

## ***Pregnancy Category C***

There are no adequate and controlled studies in pregnant women. In animal studies, levetiracetam produced evidence of developmental toxicity, including teratogenic effects, at doses similar to or greater than human therapeutic doses. Levetiracetam tablets should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

Oral administration of levetiracetam to female rats throughout pregnancy and lactation led to increased incidences of minor fetal skeletal abnormalities and retarded offspring growth pre- and/or postnatally at doses  $\geq 350$  mg/kg/day (equivalent to the maximum recommended human dose of 3000 mg [MRHD] on a mg/m<sup>2</sup> basis) and with increased pup mortality and offspring behavioral alterations at a dose of 1800 mg/kg/day (6 times the MRHD on a mg/m<sup>2</sup> basis). The developmental no effect dose was 70 mg/kg/day (0.2 times the MRHD on a mg/m<sup>2</sup> basis). There was no overt maternal toxicity at the doses used in this study.

Oral administration of levetiracetam to pregnant rabbits during the period of organogenesis resulted in increased embryofetal mortality and increased incidences of minor fetal skeletal abnormalities at doses  $\geq 600$  mg/kg/day (4 times MRHD on a mg/m<sup>2</sup> basis) and in decreased fetal weights and increased incidences of fetal malformations at a dose of 1800 mg/kg/day (12 times the MRHD on a mg/m<sup>2</sup> basis). The developmental no effect dose was 200 mg/kg/day (equivalent to the MRHD on a mg/m<sup>2</sup> basis). Maternal toxicity was also observed at 1800 mg/kg/day.

When levetiracetam was administered orally to pregnant rats during the period of organogenesis, fetal weights were decreased and the incidence of fetal skeletal variations was increased at a dose of 3600 mg/kg/day (12 times the MRHD). 1200 mg/kg/day (4 times the MRHD) was a developmental no effect dose. There was no evidence of maternal toxicity in this study.

Treatment of rats with levetiracetam during the last third of gestation and throughout lactation produced no adverse developmental or maternal effects at doses of up to 1800 mg/kg/day (6 times the MRHD on a mg/m<sup>2</sup> basis).

## ***Pregnancy Registry***

To provide information regarding the effects of *in utero* exposure to levetiracetam tablets, physicians are advised to recommend that pregnant patients taking levetiracetam tablets enroll in the North American Antiepileptic Drug (NAAED) pregnancy registry. This can be done by calling the toll free number 1-888-233-2334, and must be done by the patients themselves. Information on the registry can also be found at the website <http://www.aedpregnancyregistry.org/>.

## **8.2 Labor and Delivery**

The effect of levetiracetam tablets on labor and delivery in humans is unknown.

## **8.3 Nursing Mothers**

Levetiracetam is excreted in human milk. Because of the potential for serious adverse reactions in nursing infants from levetiracetam tablets, a decision should be made whether to discontinue nursing or discontinue the drug, taking into account the importance of the drug to the mother.

## 8.4 Pediatric Use

The safety and effectiveness of levetiracetam tablets in the adjunctive treatment of partial onset seizures in pediatric patients age 1 month to 16 years old with epilepsy have been established [see *Clinical Studies (14.1)*]. The dosing recommendation in these pediatric patients varies according to age group and is weight-based [see *Dosage and Administration (2.2)*].

The safety and effectiveness of levetiracetam tablets as adjunctive treatment of myoclonic seizures in adolescents 12 years of age and older with juvenile myoclonic epilepsy have been established [ see *Clinical Studies (14.2)*].

The safety and effectiveness of levetiracetam tablets as adjunctive therapy in the treatment of primary generalized tonic-clonic seizures in pediatric patients 6 years of age and older with idiopathic generalized epilepsy have been established [see *Clinical Studies (14.3)*].

A 3-month, randomized, double-blind, placebo-controlled study was performed to assess the neurocognitive and behavioral effects of levetiracetam tablets as adjunctive therapy in 98 (levetiracetam tablets N = 64, placebo N = 34) pediatric patients, ages 4 to 16 years old, with partial seizures that were inadequately controlled. The target dose was 60 mg/kg/day. Neurocognitive effects were measured by the Leiter-R Attention and Memory (AM) Battery, which measures various aspects of a child's memory and attention. Although no substantive differences were observed between the placebo and drug treated groups in the median change from baseline in this battery, the study was not adequate to assess formal statistical non-inferiority of the drug and placebo. The Achenbach Child Behavior Checklist (CBCL/6-18), a standardized validated tool used to assess a child's competencies and behavioral/emotional problems, was also assessed in this study. An analysis of the CBCL/6-18 indicated on average a worsening in levetiracetam tablets-treated patients in aggressive behavior, one of the eight syndrome scores [see *Warnings and Precautions (5.1)*].

Studies of levetiracetam in juvenile rats (dosing from day 4 through day 52 of age) and dogs (dosing from week 3 through week 7 of age) at doses of up to 1800 mg/kg/day (approximately 7 and 24 times, respectively, the maximum recommended pediatric dose of 60 mg/kg/day on a mg/m<sup>2</sup> basis) did not indicate a potential for age-specific toxicity.

## 8.5 Geriatric Use

There were 347 subjects in clinical studies of levetiracetam tablets that were 65 and over. No overall differences in safety were observed between these subjects and younger subjects. There were insufficient numbers of elderly subjects in controlled trials of epilepsy to adequately assess the effectiveness of levetiracetam tablets in these patients.

Levetiracetam is known to be substantially excreted by the kidney, and the risk of adverse reactions to this drug may be greater in patients with impaired renal function. Because elderly patients are more likely to have decreased renal function, care should be taken in dose selection, and it may be useful to monitor renal function [see *Clinical Pharmacology (12.3)*].

## 8.6 Renal Impairment

Clearance of levetiracetam is decreased in patients with renal impairment and is correlated with creatinine clearance [see *Clinical Pharmacology* (12.3)] . Dose adjustment is recommended for patients with impaired renal function and supplemental doses should be given to patients after dialysis [see *Dosage and Administration* (2.5)].

## **10 OVERDOSAGE**

### **10.1 Signs, Symptoms and Laboratory Findings of Acute Overdosage in Humans**

The highest known dose of levetiracetam tablets received in the clinical development program was 6000 mg/day. Other than drowsiness, there were no adverse reactions in the few known cases of overdose in clinical trials. Cases of somnolence, agitation, aggression, depressed level of consciousness, respiratory depression and coma were observed with levetiracetam tablets overdoses in postmarketing use.

### **10.2 Management of Overdose**

There is no specific antidote for overdose with levetiracetam tablets. If indicated, elimination of unabsorbed drug should be attempted by emesis or gastric lavage; usual precautions should be observed to maintain airway. General supportive care of the patient is indicated including monitoring of vital signs and observation of the patient's clinical status. A Certified Poison Control Center should be contacted for up to date information on the management of overdose with levetiracetam tablets.

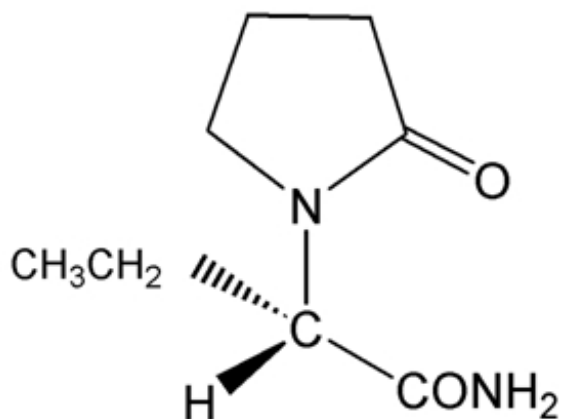
### **10.3 Hemodialysis**

Standard hemodialysis procedures result in significant clearance of levetiracetam (approximately 50% in 4 hours) and should be considered in cases of overdose. Although hemodialysis has not been performed in the few known cases of overdose, it may be indicated by the patient's clinical state or in patients with significant renal impairment.

## **11 DESCRIPTION**

Levetiracetam is an antiepileptic drug available as 250 mg, 500 mg, 750 mg or 1000 mg tablets for oral administration.

The chemical name of levetiracetam, a single enantiomer, is (-)-(S)- $\alpha$ -ethyl-2-oxo-1-pyrrolidine acetamide, its molecular formula is  $C_8H_{14}N_2O_2$  and its molecular weight is 170.21. Levetiracetam is chemically unrelated to existing antiepileptic drugs (AEDs). It has the following structural formula:



Levetiracetam, USP is a white to off-white crystalline powder with a faint odor and a bitter taste. It is very soluble in water (104 g/100 mL). It is freely soluble in chloroform (65.3 g/100 mL) and in methanol (53.6 g/100 mL), soluble in ethanol (16.5 g/100 mL), sparingly soluble in acetonitrile (5.7 g/100 mL) and practically insoluble in n-hexane. (Solubility limits are expressed as g/100 mL solvent.)

Levetiracetam tablets, USP contain the labeled amount of levetiracetam. Inactive ingredients: colloidal silicon dioxide, croscarmellose sodium, hypromellose, magnesium stearate, microcrystalline cellulose, polydextrose, polyethylene glycol, povidone, sodium lauryl sulfate, titanium dioxide and triacetin.

*Levetiracetam Tablets USP, 250 mg, 500 mg, 750 mg and 1000 mg Meet USP Dissolution Test 2.*

## 12 CLINICAL PHARMACOLOGY

### 12.1 Mechanism of Action

The precise mechanism(s) by which levetiracetam exerts its antiepileptic effect is unknown. The antiepileptic activity of levetiracetam was assessed in a number of animal models of epileptic seizures. Levetiracetam did not inhibit single seizures induced by maximal stimulation with electrical current or different chemoconvulsants and showed only minimal activity in submaximal stimulation and in threshold tests. Protection was observed, however, against secondarily generalized activity from focal seizures induced by pilocarpine and kainic acid, two chemoconvulsants that induce seizures that mimic some features of human complex partial seizures with secondary generalization. Levetiracetam also displayed inhibitory properties in the kindling model in rats, another model of human complex partial seizures, both during kindling development and in the fully kindled state. The predictive value of these animal models for specific types of human epilepsy is uncertain.

*In vitro* and *in vivo* recordings of epileptiform activity from the hippocampus have shown that levetiracetam inhibits burst firing without affecting normal neuronal excitability, suggesting that levetiracetam may selectively prevent hypersynchronization of epileptiform burst firing and propagation of seizure activity.

Levetiracetam at concentrations of up to 10  $\mu$ M did not demonstrate binding affinity for

a variety of known receptors, such as those associated with benzodiazepines, GABA (gamma-aminobutyric acid), glycine, NMDA (N-methyl-D-aspartate), re-uptake sites, and second messenger systems. Furthermore, *in vitro* studies have failed to find an effect of levetiracetam on neuronal voltage-gated sodium or T-type calcium currents and levetiracetam does not appear to directly facilitate GABAergic neurotransmission. However, *in vitro* studies have demonstrated that levetiracetam opposes the activity of negative modulators of GABA- and glycine-gated currents and partially inhibits N-type calcium currents in neuronal cells.

A saturable and stereoselective neuronal binding site in rat brain tissue has been described for levetiracetam. Experimental data indicate that this binding site is the synaptic vesicle protein SV2A, thought to be involved in the regulation of vesicle exocytosis. Although the molecular significance of levetiracetam binding to SV2A is not understood, levetiracetam and related analogs showed a rank order of affinity for SV2A which correlated with the potency of their antiseizure activity in audiogenic seizure-prone mice. These findings suggest that the interaction of levetiracetam with the SV2A protein may contribute to the antiepileptic mechanism of action of the drug.

## **12.2 Pharmacodynamics**

### ***Effects on QTc Interval***

The effect of levetiracetam tablets on QTc prolongation was evaluated in a randomized, double-blind, positive-controlled (moxifloxacin 400 mg) and placebo-controlled crossover study of levetiracetam tablets (1000 mg or 5000 mg) in 52 healthy subjects. The upper bound of the 90% confidence interval for the largest placebo-adjusted, baseline-corrected QTc was below 10 milliseconds. Therefore, there was no evidence of significant QTc prolongation in this study.

## **12.3 Pharmacokinetics**

### ***Absorption and Distribution***

Absorption of levetiracetam is rapid, with peak plasma concentrations occurring in about an hour following oral administration in fasted subjects. The oral bioavailability of levetiracetam tablets is 100% and the tablets and oral solution are bioequivalent in rate and extent of absorption. Food does not affect the extent of absorption of levetiracetam but it decreases  $C_{max}$  by 20% and delays  $T_{max}$  by 1.5 hours. The pharmacokinetics of levetiracetam are linear over the dose range of 500 mg to 5000 mg. Steady state is achieved after 2 days of multiple twice-daily dosing. Levetiracetam and its major metabolite are less than 10% bound to plasma proteins; clinically significant interactions with other drugs through competition for protein binding sites are therefore unlikely.

### ***Metabolism***

Levetiracetam is not extensively metabolized in humans. The major metabolic pathway is the enzymatic hydrolysis of the acetamide group, which produces the carboxylic acid metabolite, ucb L057 (24% of dose) and is not dependent on any liver cytochrome P450 isoenzymes. The major metabolite is inactive in animal seizure models. Two minor metabolites were identified as the product of hydroxylation of the 2-oxo-pyrrolidine ring (2% of dose) and opening of the 2-oxo-pyrrolidine ring in position 5 (1% of dose). There is no enantiomeric interconversion of levetiracetam or its major metabolite.

## **Elimination**

Levetiracetam plasma half-life in adults is  $7 \pm 1$  hour and is unaffected by either dose or repeated administration. Levetiracetam is eliminated from the systemic circulation by renal excretion as unchanged drug which represents 66% of administered dose. The total body clearance is 0.96 mL/min/kg and the renal clearance is 0.6 mL/min/kg. The mechanism of excretion is glomerular filtration with subsequent partial tubular reabsorption. The metabolite ucb L057 is excreted by glomerular filtration and active tubular secretion with a renal clearance of 4 mL/min/kg. Levetiracetam elimination is correlated to creatinine clearance. Levetiracetam clearance is reduced in patients with renal impairment [see *Use in Specific Populations (8.6)* and *Dosage and Administration (2.5)*].

## **Specific Populations**

### **Elderly**

Pharmacokinetics of levetiracetam were evaluated in 16 elderly subjects (age 61 to 88 years) with creatinine clearance ranging from 30 to 74 mL/min. Following oral administration of twice-daily dosing for 10 days, total body clearance decreased by 38% and the half-life was 2.5 hours longer in the elderly compared to healthy adults. This is most likely due to the decrease in renal function in these subjects.

### **Pediatric Patients**

Pharmacokinetics of levetiracetam were evaluated in 24 pediatric patients (age 6 to 12 years) after single dose (20 mg/kg). The body weight adjusted apparent clearance of levetiracetam was approximately 40% higher than in adults.

A repeat dose pharmacokinetic study was conducted in pediatric patients (age 4 to 12 years) at doses of 20 mg/kg/day, 40 mg/kg/day, and 60 mg/kg/day. The evaluation of the pharmacokinetic profile of levetiracetam and its metabolite (ucb L057) in 14 pediatric patients demonstrated rapid absorption of levetiracetam at all doses with a  $T_{max}$  of about 1 hour and a  $t_{1/2}$  of 5 hours across the three dosing levels. The pharmacokinetics of levetiracetam in children was linear between 20 to 60 mg/kg/day. The potential interaction of levetiracetam with other AEDs was also evaluated in these patients. Levetiracetam had no significant effect on the plasma concentrations of carbamazepine, valproic acid, topiramate or lamotrigine. However, there was about a 22% increase of apparent clearance of levetiracetam when it was coadministered with an enzyme-inducing AED (e.g., carbamazepine).

Following single dose administration (20 mg/kg) of a 10% oral solution to children with epilepsy (1 month to < 4 years), levetiracetam was rapidly absorbed and peak plasma concentrations were observed approximately 1 hour after dosing. The pharmacokinetic results indicated that half-life was shorter (5.3 h) than for adults (7.2 h) and apparent clearance was faster (1.5 mL/min/kg) than for adults (0.96 mL/min/kg).

Population pharmacokinetic analysis showed that body weight was significantly correlated to the clearance of levetiracetam in pediatric patients; clearance increased with an increase in body weight.

### **Pregnancy**

Levetiracetam levels may decrease during pregnancy.

### **Gender**

Levetiracetam  $C_{\max}$  and AUC were 20% higher in women (N = 11) compared to men (N = 12). However, clearances adjusted for body weight were comparable.

### **Race**

Formal pharmacokinetic studies of the effects of race have not been conducted. Cross-study comparisons involving Caucasians (N = 12) and Asians (N = 12), however, show that pharmacokinetics of levetiracetam were comparable between the two races.

Because levetiracetam is primarily renally excreted and there are no important racial differences in creatinine clearance, pharmacokinetic differences due to race are not expected.

### **Renal Impairment**

The disposition of levetiracetam was studied in adult subjects with varying degrees of renal function. Total body clearance of levetiracetam is reduced in patients with impaired renal function by 40% in the mild group (CLcr = 50 to 80 mL/min), 50% in the moderate group (CLcr = 30 to 50 mL/min) and 60% in the severe renal impairment group (CLcr < 30 mL/min). Clearance of levetiracetam is correlated with creatinine clearance.

In anuric (end stage renal disease) patients, the total body clearance decreased 70% compared to normal subjects (CLcr > 80 mL/min). Approximately 50% of the pool of levetiracetam in the body is removed during a standard 4-hour hemodialysis procedure [see *Dosage and Administration* (2.5)].

### **Hepatic Impairment**

In subjects with mild (Child-Pugh A) to moderate (Child-Pugh B) hepatic impairment, the pharmacokinetics of levetiracetam were unchanged. In patients with severe hepatic impairment (Child-Pugh C), total body clearance was 50% that of normal subjects, but decreased renal clearance accounted for most of the decrease. No dose adjustment is needed for patients with hepatic impairment.

### **Drug Interactions**

*In vitro* data on metabolic interactions indicate that levetiracetam is unlikely to produce, or be subject to, pharmacokinetic interactions. Levetiracetam and its major metabolite, at concentrations well above  $C_{\max}$  levels achieved within the therapeutic dose range, are neither inhibitors of, nor high affinity substrates for, human liver cytochrome P450 isoforms, epoxide hydrolase or UDP-glucuronidation enzymes. In addition, levetiracetam does not affect the *in vitro* glucuronidation of valproic acid.

Potential pharmacokinetic interactions of or with levetiracetam were assessed in clinical pharmacokinetic studies (phenytoin, valproate, warfarin, digoxin, oral contraceptive, probenecid) and through pharmacokinetic screening in the placebo-controlled clinical studies in epilepsy patients.

### **Phenytoin**

Levetiracetam tablets (3000 mg daily) had no effect on the pharmacokinetic disposition



of phenytoin in patients with refractory epilepsy. Pharmacokinetics of levetiracetam were also not affected by phenytoin.

### ***Valproate***

Levetiracetam tablets (1500 mg twice daily) did not alter the pharmacokinetics of valproate in healthy volunteers. Valproate 500 mg twice daily did not modify the rate or extent of levetiracetam absorption or its plasma clearance or urinary excretion. There also was no effect on exposure to and the excretion of the primary metabolite, ucb L057.

### ***Other Antiepileptic Drugs***

Potential drug interactions between levetiracetam tablets and other AEDs (carbamazepine, gabapentin, lamotrigine, phenobarbital, phenytoin, primidone and valproate) were also assessed by evaluating the serum concentrations of levetiracetam and these AEDs during placebo-controlled clinical studies. These data indicate that levetiracetam does not influence the plasma concentration of other AEDs and that these AEDs do not influence the pharmacokinetics of levetiracetam.

### ***Effect of AEDs in Pediatric Patients***

There was about a 22% increase of apparent total body clearance of levetiracetam when it was coadministered with enzyme-inducing AEDs. Dose adjustment is not recommended. Levetiracetam had no effect on plasma concentrations of carbamazepine, valproate, topiramate, or lamotrigine.

### ***Oral Contraceptives***

Levetiracetam tablets (500 mg twice daily) did not influence the pharmacokinetics of an oral contraceptive containing 0.03 mg ethinyl estradiol and 0.15 mg levonorgestrel, or of the luteinizing hormone and progesterone levels, indicating that impairment of contraceptive efficacy is unlikely. Coadministration of this oral contraceptive did not influence the pharmacokinetics of levetiracetam.

### ***Digoxin***

Levetiracetam tablets (1000 mg twice daily) did not influence the pharmacokinetics and pharmacodynamics (ECG) of digoxin given as a 0.25 mg dose every day. Coadministration of digoxin did not influence the pharmacokinetics of levetiracetam.

### ***Warfarin***

Levetiracetam tablets (1000 mg twice daily) did not influence the pharmacokinetics of R and S warfarin. Prothrombin time was not affected by levetiracetam. Coadministration of warfarin did not affect the pharmacokinetics of levetiracetam.

### ***Probenecid***

Probenecid, a renal tubular secretion blocking agent, administered at a dose of 500 mg four times a day, did not change the pharmacokinetics of levetiracetam 1000 mg twice daily.  $C_{ss_{max}}$  of the metabolite, ucb L057, was approximately doubled in the presence of probenecid while the fraction of drug excreted unchanged in the urine remained the

same. Renal clearance of ucb L057 in the presence of probenecid decreased 60%, probably related to competitive inhibition of tubular secretion of ucb L057. The effect of levetiracetam tablets on probenecid was not studied.

## **13 NONCLINICAL TOXICOLOGY**

### **13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility**

#### ***Carcinogenesis***

Rats were dosed with levetiracetam in the diet for 104 weeks at doses of 50 mg/kg/day, 300 mg/kg/day and 1800 mg/kg/day. The highest dose is 6 times the maximum recommended daily human dose (MRHD) of 3000 mg on a  $\text{mg}/\text{m}^2$  basis and it also provided systemic exposure (AUC) approximately 6 times that achieved in humans receiving the MRHD. There was no evidence of carcinogenicity. In mice, oral administration of levetiracetam for 80 weeks (doses up to 960 mg/kg/day) or 2 years (doses up to 4000 mg/kg/day, lowered to 3000 mg/kg/day after 45 weeks due to intolerability) was not associated with an increase in tumors. The highest dose tested in mice for 2 years (3000 mg/kg/day) is approximately 5 times the MRHD on a  $\text{mg}/\text{m}^2$  basis.

#### ***Mutagenesis***

Levetiracetam was not mutagenic in the Ames test or in mammalian cells *in vitro* in the Chinese hamster ovary/HGPRT locus assay. It was not clastogenic in an *in vitro* analysis of metaphase chromosomes obtained from Chinese hamster ovary cells or in an *in vivo* mouse micronucleus assay. The hydrolysis product and major human metabolite of levetiracetam (ucb L057) was not mutagenic in the Ames test or the *in vitro* mouse lymphoma assay.

#### ***Impairment of Fertility***

No adverse effects on male or female fertility or reproductive performance were observed in rats at oral doses up to 1800 mg/kg/day (6 times the maximum recommended human dose on a  $\text{mg}/\text{m}^2$  or systemic exposure [AUC] basis).

## **14 CLINICAL STUDIES**

### **14.1 Partial Onset Seizures**

#### ***Effectiveness in Partial Onset Seizures in Adults with Epilepsy***

The effectiveness of levetiracetam tablets as adjunctive therapy (added to other antiepileptic drugs) in adults was established in three multicenter, randomized, double-blind, placebo-controlled clinical studies in patients who had refractory partial onset seizures with or without secondary generalization. The tablet formulation was used in all these studies. In these studies, 904 patients were randomized to placebo, 1000 mg, 2000 mg, or 3000 mg/day. Patients enrolled in Study 1 or Study 2 had refractory partial onset seizures for at least two years and had taken two or more classical AEDs. Patients enrolled in Study 3 had refractory partial onset seizures for at least 1 year and had

taken one classical AED. At the time of the study, patients were taking a stable dose regimen of at least one and could take a maximum of two AEDs. During the baseline period, patients had to have experienced at least two partial onset seizures during each 4-week period.

### **Study 1**

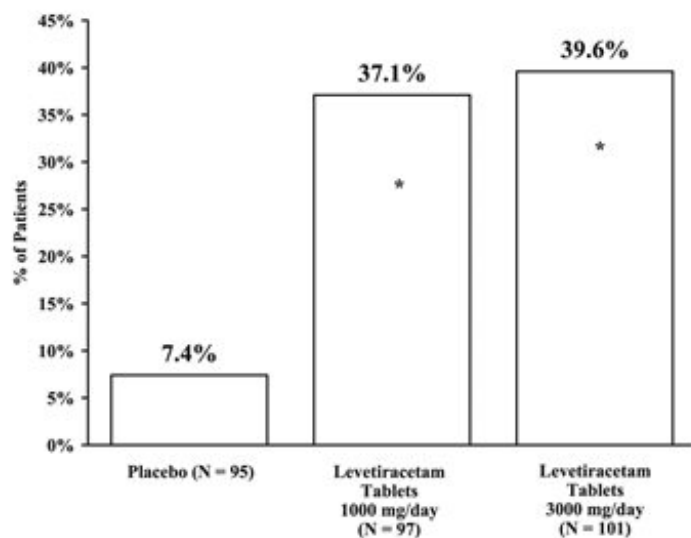
Study 1 was a double-blind, placebo-controlled, parallel-group study conducted at 41 sites in the United States comparing levetiracetam tablets 1000 mg/day (N = 97), levetiracetam tablets 3000 mg/day (N = 101) and placebo (N = 95) given in equally divided doses twice daily. After a prospective baseline period of 12 weeks, patients were randomized to one of the three treatment groups described above. The 18-week treatment period consisted of a 6-week titration period, followed by a 12-week fixed dose evaluation period, during which concomitant AED regimens were held constant. The primary measure of effectiveness was a between group comparison of the percent reduction in weekly partial seizure frequency relative to placebo over the entire randomized treatment period (titration + evaluation period). Secondary outcome variables included the responder rate (incidence of patients with  $\geq 50\%$  reduction from baseline in partial onset seizure frequency). The results of the analysis of Study 1 are displayed in Table 10.

**Table 10: Reduction in Mean Over Placebo in Weekly Frequency of Partial Onset Seizures in Study 1**

	Placebo (N = 95)	Levetiracetam Tablets 1000 mg/day (N = 97)	Levetiracetam Tablets 3000 mg/day (N = 101)
Percent reduction in partial seizure frequency over placebo	-	26.1% *	30.1% *

\* statistically significant vs. placebo

The percentage of patients (y-axis) who achieved  $\geq 50\%$  reduction in weekly seizure rates from baseline in partial onset seizure frequency over the entire randomized treatment period (titration + evaluation period) within the three treatment groups (x-axis) is presented in Figure 1.



\*statistically significant versus placebo

## Study 2

Study 2 was a double-blind, placebo-controlled, cross-over study conducted at 62 centers in Europe comparing levetiracetam tablets 1000 mg/day (N = 106), levetiracetam tablets 2000 mg/day (N = 105) and placebo (N = 111) given in equally divided doses twice daily.

The first period of the study (Period A) was designed to be analyzed as a parallel-group study. After a prospective baseline period of up to 12 weeks, patients were randomized to one of the three treatment groups described above. The 16-week treatment period consisted of the 4-week titration period followed by a 12-week fixed dose evaluation period, during which concomitant AED regimens were held constant. The primary measure of effectiveness was a between group comparison of the percent reduction in weekly partial seizure frequency relative to placebo over the entire randomized treatment period (titration + evaluation period). Secondary outcome variables included the responder rate (incidence of patients with  $\geq 50\%$  reduction from baseline in partial onset seizure frequency). The results of the analysis of Period A are displayed in Table 11.

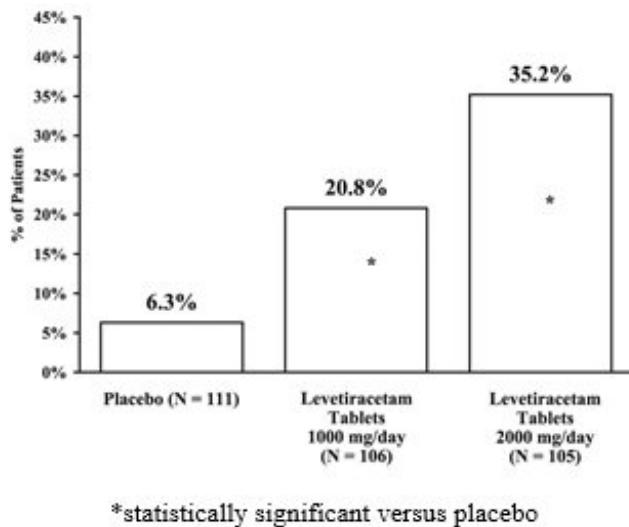
**Table 11: Reduction in Mean Over Placebo in Weekly Frequency of Partial Onset Seizures in Study 2: Period A**

	Placebo (N = 111)	Levetiracetam Tablets 1000 mg/day (N = 106)	Levetiracetam Tablets 2000 mg/day (N = 105)
Percent reduction in partial seizure frequency over placebo	-	17.1% *	21.4% *

\* statistically significant vs. placebo

The percentage of patients (y-axis) who achieved  $\geq 50\%$  reduction in weekly seizure rates from baseline in partial onset seizure frequency over the entire randomized treatment period (titration + evaluation period) within the three treatment groups (x-

axis) is presented in Figure 2.



The comparison of levetiracetam tablets 2000 mg/day to levetiracetam tablets 1000 mg/day for responder rate was statistically significant (  $P = 0.02$ ). Analysis of the trial as a cross-over yielded similar results.

### Study 3

Study 3 was a double-blind, placebo-controlled, parallel-group study conducted at 47 centers in Europe comparing levetiracetam tablets 3000 mg/day (N = 180) and placebo (N = 104) in patients with refractory partial onset seizures, with or without secondary generalization, receiving only one concomitant AED. Study drug was given in two divided doses. After a prospective baseline period of 12 weeks, patients were randomized to one of two treatment groups described above. The 16-week treatment period consisted of a 4-week titration period, followed by a 12-week fixed dose evaluation period, during which concomitant AED doses were held constant. The primary measure of effectiveness was a between group comparison of the percent reduction in weekly seizure frequency relative to placebo over the entire randomized treatment period (titration + evaluation period). Secondary outcome variables included the responder rate (incidence of patients with  $\geq 50\%$  reduction from baseline in partial onset seizure frequency). Table 12 displays the results of the analysis of Study 3.

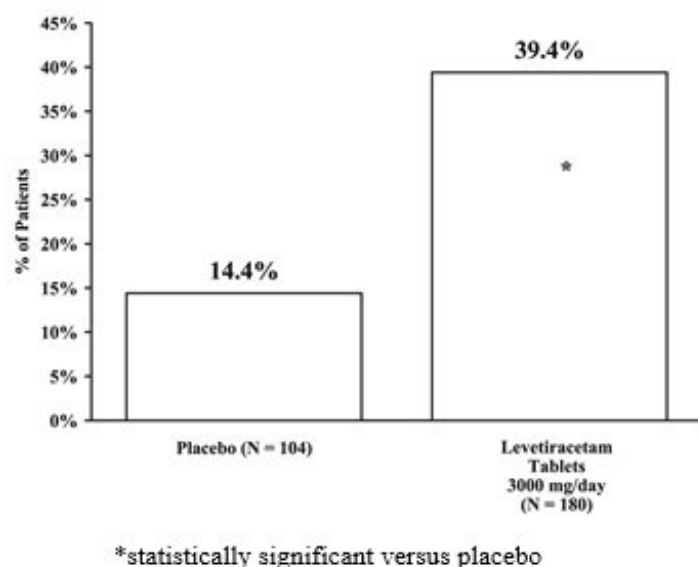
**Table 12: Reduction in Mean Over Placebo in Weekly Frequency of Partial Onset Seizures in Study 3**

	Placebo (N = 104)	Levetiracetam Tablets 3000 mg/day (N = 180)
Percent reduction in partial seizure frequency over placebo	-	23% *

\* statistically significant vs. placebo

The percentage of patients (y-axis) who achieved  $\geq 50\%$  reduction in weekly seizure rates from baseline in partial onset seizure frequency over the entire randomized

treatment period (titration + evaluation period) within the two treatment groups (x-axis) is presented in Figure 3.



### ***Effectiveness in Partial Onset Seizures in Pediatric Patients 4 Years to 16 Years with Epilepsy***

The effectiveness of levetiracetam tablets as adjunctive therapy (added to other antiepileptic drugs) in pediatric patients was established in one multicenter, randomized double-blind, placebo-controlled study (Study 4), conducted at 60 sites in North America, in pediatric patients 4 to 16 years of age with partial seizures uncontrolled by standard antiepileptic drugs (AEDs). Eligible patients on a stable dose of 1 to 2 AEDs, who still experienced at least 4 partial onset seizures during the 4 weeks prior to screening, as well as at least 4 partial onset seizures in each of the two 4-week baseline periods, were randomized to receive either levetiracetam tablets or placebo. The enrolled population included 198 patients (levetiracetam tablets N = 101, placebo N = 97) with refractory partial onset seizures, whether or not secondarily generalized. The study consisted of an 8-week baseline period and 4-week titration period followed by a 10-week evaluation period. Dosing was initiated at a dose of 20 mg/kg/day in two divided doses. During the treatment period, levetiracetam tablets doses were adjusted in 20 mg/kg/day increments, at 2-week intervals to the target dose of 60 mg/kg/day. The primary measure of effectiveness was a between group comparison of the percent reduction in weekly partial seizure frequency relative to placebo over the entire 14-week randomized treatment period (titration + evaluation period). Secondary outcome variables included the responder rate (incidence of patients with  $\geq 50\%$  reduction from baseline in partial onset seizure frequency per week). Table 13 displays the results of this study.

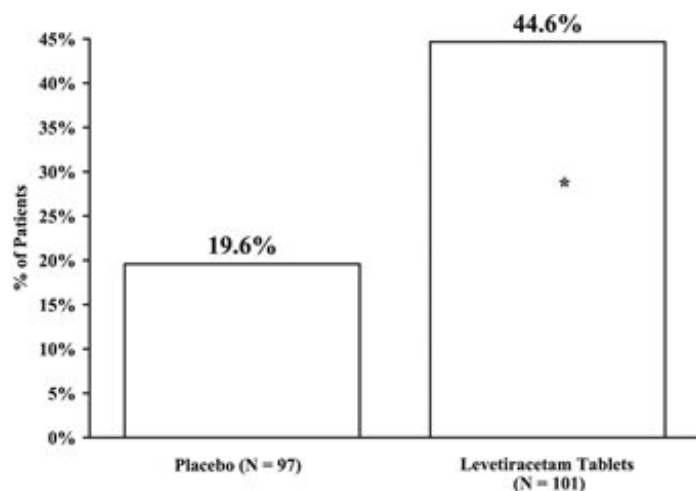
**Table 13: Reduction in Mean Over Placebo in Weekly Frequency of Partial Onset Seizures in Study 4**

	Placebo (N = 97)	Levetiracetam Tablets
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		(N = 101)
Percent reduction in partial seizure frequency over placebo	-	26.8% *

\* statistically significant vs. placebo

The percentage of patients (y-axis) who achieved  $\geq 50\%$  reduction in weekly seizure rates from baseline in partial onset seizure frequency over the entire randomized treatment period (titration + evaluation period) within the two treatment groups (x-axis) is presented in Figure 4.

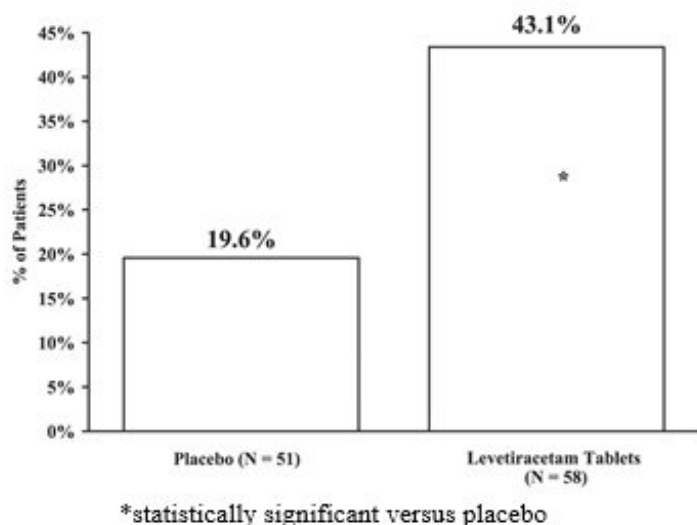


\*statistically significant versus placebo

### ***Effectiveness in Partial Onset Seizures in Pediatric Patients 1 Month to < 4 Years with Epilepsy***

The effectiveness of levetiracetam tablets as adjunctive therapy in pediatric patients was established in one multicenter, randomized double-blind, placebo-controlled study (Study 5), conducted at 62 sites in North America, South America, and Europe in pediatric patients 1 month to less than 4 years of age with partial seizures, uncontrolled by standard epileptic drugs (AEDs). Eligible patients on a stable dose of 1 to 2 AEDs, who experienced at least 2 partial onset seizures during the 48-hour baseline video EEG were randomized to receive either levetiracetam tablets or placebo. The enrolled population included 116 patients (levetiracetam tablets N = 60, placebo N = 56) with refractory partial onset seizures, whether or not secondarily generalized. Randomization was stratified by age range as follows: 1 month to less than 6 months of age (N = 4 treated with levetiracetam tablets), 6 months to less than 1 year of age (N = 8 treated with levetiracetam tablets), 1 year to less than 2 years of age (N = 20 treated with levetiracetam tablets), and 2 years to less than 4 years of age (N = 28 treated with levetiracetam tablets). The study consisted of a 5-day evaluation period which included a 1-day titration period followed by a 4-day maintenance period. Levetiracetam tablets dosing was determined by age and weight as follows: children 1 month to less than 6 months old were randomized to a target dose of 40 mg/kg/day, and children 6 months to less than 4 years old were randomized to a target dose of 50 mg/kg/day. The primary measure of effectiveness was the responder rate (percent of patients with  $\geq 50\%$  reduction from baseline in average daily partial onset seizure frequency) assessed by a blinded central reader using a 48-hour video EEG performed during the last two days of

the 4-day maintenance period. A total of 109 patients were included in the efficacy analysis. A statistically significant difference between levetiracetam tablets and placebo was observed (see Figure 5). The treatment effect associated with levetiracetam tablets were consistent across age groups.



## 14.2 Myoclonic Seizures in Patients with Juvenile Myoclonic Epilepsy

### ***Effectiveness of Myoclonic Seizures in Patients = 12 Years of Age with Juvenile Myoclonic Epilepsy (JME)***

The effectiveness of levetiracetam tablets as adjunctive therapy (added to other antiepileptic drugs) in patients 12 years of age and older with juvenile myoclonic epilepsy (JME) experiencing myoclonic seizures was established in one multicenter, randomized, double-blind, placebo-controlled study (Study 6), conducted at 37 sites in 14 countries. Of the 120 patients enrolled, 113 had a diagnosis of confirmed or suspected JME. Eligible patients on a stable dose of 1 antiepileptic drug (AED) experiencing one or more myoclonic seizures per day for at least 8 days during the prospective 8-week baseline period were randomized to either levetiracetam tablets or placebo (levetiracetam tablets N = 60, placebo N = 60). Patients were titrated over 4 weeks to a target dose of 3000 mg/day and treated at a stable dose of 3000 mg/day over 12 weeks (evaluation period). Study drug was given in 2 divided doses.

The primary measure of effectiveness was the proportion of patients with at least 50% reduction in the number of days per week with one or more myoclonic seizures during the treatment period (titration + evaluation periods) as compared to baseline. Table 14 displays the results for the 113 patients with JME in this study.

**Table 14: Responder Rate ( $\geq 50\%$  Reduction from Baseline) in Myoclonic Seizure Days per Week for Patients with JME in Study 6**

	Placebo (N = 59)	Levetiracetam Tablets (N = 54)
Percentage of responders	23.7%	60.4% *

\* statistically significant vs. placebo



## 14.3 Primary Generalized Tonic-Clonic Seizures

### ***Effectiveness in Primary Generalized Tonic-Clonic Seizures in Patients $\geq$ 6 Years of Age***

The effectiveness of levetiracetam tablets as adjunctive therapy (added to other antiepileptic drugs) in patients 6 years of age and older with idiopathic generalized epilepsy experiencing primary generalized tonic-clonic (PGTC) seizures was established in one multicenter, randomized, double-blind, placebo-controlled study (Study 7), conducted at 50 sites in 8 countries. Eligible patients on a stable dose of 1 or 2 antiepileptic drugs (AEDs) experiencing at least 3 PGTC seizures during the 8-week combined baseline period (at least one PGTC seizure during the 4 weeks prior to the prospective baseline period and at least one PGTC seizure during the 4-week prospective baseline period) were randomized to either levetiracetam tablets or placebo. The 8-week combined baseline period is referred to as “baseline” in the remainder of this section. Patients were titrated over 4 weeks to a target dose of 3000 mg/day for adults or a pediatric target dose of 60 mg/kg/day and treated at a stable dose of 3000 mg/day (or 60 mg/kg/day for children) over 20 weeks (evaluation period). Study drug was given in 2 equally divided doses per day. The primary measure of effectiveness was the percent reduction from baseline in weekly PGTC seizure frequency for levetiracetam tablets and placebo treatment groups over the treatment period (titration + evaluation periods). The population included 164 patients (levetiracetam tablets N = 80, placebo N = 84) with idiopathic generalized epilepsy (predominately juvenile myoclonic epilepsy, juvenile absence epilepsy, childhood absence epilepsy, or epilepsy with Grand Mal seizures on awakening) experiencing primary generalized tonic-clonic seizures. Each of these syndromes of idiopathic generalized epilepsy was well represented in this patient population.

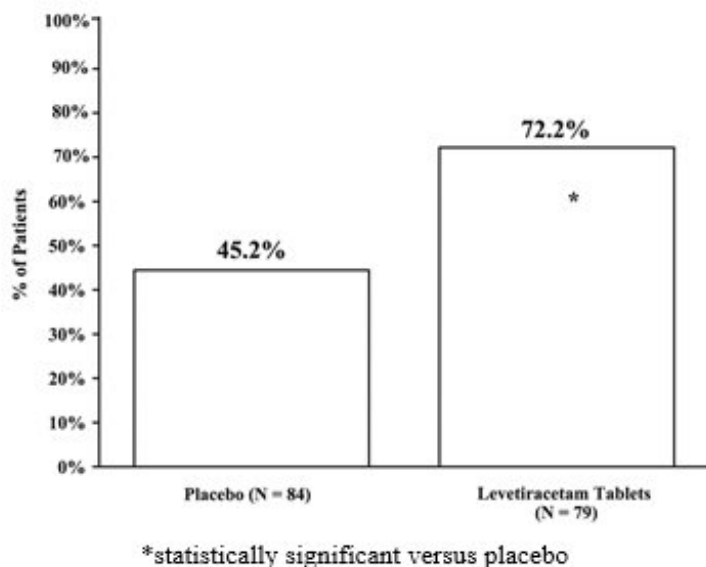
There was a statistically significant decrease from baseline in PGTC frequency in the levetiracetam tablets-treated patients compared to the placebo-treated patients.

**Table 15: Median Percent Reduction from Baseline in PGTC Seizure Frequency per Week in Study 7**

	Placebo (N = 84)	Levetiracetam Tablets (N = 78)
Percent reduction in PGTC seizure frequency	44.6%	77.6% *

\* statistically significant vs. placebo

The percentage of patients (y-axis) who achieved  $\geq$  50% reduction in weekly seizure rates from baseline in PGTC seizure frequency over the entire randomized treatment period (titration + evaluation period) within the two treatment groups (x-axis) is presented in Figure 6.



## 16 HOW SUPPLIED/STORAGE AND HANDLING

### 16.1 How Supplied

Levetiracetam Tablets, USP are available containing 500 mg of levetiracetam, USP.

The 500 mg tablets are white, film-coated, modified capsule-shaped scored tablets debossed with **M** to the left of the score and **615** to the right of the score on one side of the tablet and blank on the other side. They are available as follows:

Overbagged with 10 tablets per bag, NDC 55154-5699-0

### 16.2 Storage

**Store at 20° to 25°C (68° to 77°F). [See USP Controlled Room Temperature.]**

**PHARMACIST:** Dispense a Medication Guide with each prescription.

## 17 PATIENT COUNSELING INFORMATION

Advise the patient to read the FDA-approved Patient Labeling ( Medication Guide).

### ***Suicidal Behavior and Ideation***

Counsel patients, their caregivers, and/or families that antiepileptic drugs (AEDs), including levetiracetam tablets, may increase the risk of suicidal thoughts and behavior and advise patients to be alert for the emergence or worsening of symptoms of depression; unusual changes in mood or behavior; or suicidal thoughts, behavior, or thoughts about self-harm. Advise patients, their caregivers, and/or families to immediately report behaviors of concern to a healthcare provider.

### ***Psychiatric Reactions and Changes in Behavior***

Advise patients that levetiracetam tablets may cause changes in behavior (e.g., aggression, agitation, anger, anxiety, apathy, depression, hostility, and irritability) and psychotic symptoms.

### ***Effects on Driving or Operating Machinery***

Inform patients that levetiracetam tablets may cause dizziness and somnolence. Inform patients not to drive or operate machinery until they have gained sufficient experience on levetiracetam tablets to gauge whether it adversely affects their ability to drive or operate machinery.

### ***Dermatological Adverse Reactions***

Advise patients that serious dermatological adverse reactions have occurred in patients treated with levetiracetam tablets and instruct them to call their physician immediately if a rash develops.

### ***Pregnancy***

Advise patients to notify their healthcare provider if they become pregnant or intend to become pregnant during levetiracetam tablets therapy. Encourage patients to enroll in the North American Antiepileptic Drug (NAAED) pregnancy registry if they become pregnant. This registry is collecting information about the safety of antiepileptic drugs during pregnancy. To enroll, patients can call the toll free number 1-888-233-2334 [see *Use in Specific Populations (8.1)*].

## **Medication Guide**

### **Levetiracetam Tablets, USP (lee'' va tye ra' se tam)**

Read this Medication Guide before you start taking levetiracetam tablets and each time you get a refill. There may be new information. This information does not take the place of talking to your healthcare provider about your medical condition or treatment.

### **What is the most important information I should know about levetiracetam tablets?**

**Like other antiepileptic drugs, levetiracetam tablets may cause suicidal thoughts or actions in a very small number of people, about 1 in 500 people taking it.**

**Call a healthcare provider right away if you have any of these symptoms, especially if they are new, worse, or worry you:**

- thoughts about suicide or dying
- attempts to commit suicide
- new or worse depression
- new or worse anxiety
- feeling agitated or restless
- panic attacks
- trouble sleeping (insomnia)
- new or worse irritability
- acting aggressive, being angry, or violent
- acting on dangerous impulses
- an extreme increase in activity and talking (mania)
- other unusual changes in behavior or mood

**Do not stop levetiracetam tablets without first talking to a healthcare**

## **provider.**

- Stopping levetiracetam tablets suddenly can cause serious problems. Stopping a seizure medicine suddenly can cause seizures that will not stop (status epilepticus).
- Suicidal thoughts or actions can be caused by things other than medicines. If you have suicidal thoughts or actions, your healthcare provider may check for other causes.

## **How can I watch for early symptoms of suicidal thoughts and actions?**

- Pay attention to any changes, especially sudden changes, in mood, behaviors, thoughts, or feelings.
- Keep all follow-up visits with your healthcare provider as scheduled.
- Call your healthcare provider between visits as needed, especially if you are worried about symptoms.

## **What are levetiracetam tablets?**

Levetiracetam tablets are a prescription medicine taken by mouth that is used with other medicines to treat:

- partial onset seizures in people 1 month of age and older with epilepsy.
- myoclonic seizures in people 12 years of age and older with juvenile myoclonic epilepsy.
- primary generalized tonic-clonic seizures in people 6 years of age and older with certain types of generalized epilepsy.

It is not known if levetiracetam tablets are safe or effective in children under 1 month of age.

Before taking your medicine, make sure you have received the correct medicine. Compare the name above with the name on your bottle and the appearance of your medicine with the description of levetiracetam tablets provided below. Tell your pharmacist immediately if you think you have been given the wrong medicine.

The 250 mg tablets are white, film-coated, round tablets debossed with **M** above the score and **613** below the score on one side of the tablet and blank on the other side.

The 500 mg tablets are white, film-coated, modified capsule-shaped tablets debossed with **M** to the left of the score and **615** to the right of the score on one side of the tablet and blank on the other side.

The 750 mg tablets are white, film-coated, modified capsule-shaped tablets debossed with **M** to the left of the score and **617** to the right of the score on one side of the tablet and blank on the other side.

The 1000 mg tablets are white, film-coated, modified capsule-shaped tablets debossed with **M** to the left of the score and **619** to the right of the score on one side of the tablet and blank on the other side.

## **What should I tell my healthcare provider before starting levetiracetam tablets?**

Before taking levetiracetam tablets, tell your healthcare provider about all of your medical conditions, including if you:

- have or have had depression, mood problems or suicidal thoughts or behavior.
- have kidney problems.
- are pregnant or planning to become pregnant. It is not known if levetiracetam tablets will harm your unborn baby. You and your healthcare provider will have to decide if you should take levetiracetam tablets while you are pregnant. If you become pregnant while taking levetiracetam tablets, talk to your healthcare provider about registering with the North American Antiepileptic Drug Pregnancy Registry. You can enroll in this registry by calling 1-888-233-2334. The purpose of this registry is to collect information about the safety of levetiracetam tablets and other antiepileptic medicine during pregnancy.
- are breast-feeding. Levetiracetam can pass into your milk and may harm your baby. You and your healthcare provider should discuss whether you should take levetiracetam tablets or breast-feed; you should not do both.

Tell your healthcare provider about all the medicines you take, including prescription and nonprescription medicines, vitamins, and herbal supplements. Do not start a new medicine without first talking with your healthcare provider.

Know the medicines you take. Keep a list of them to show your healthcare provider and pharmacist each time you get a new medicine.

### **How should I take levetiracetam tablets?**

Take levetiracetam tablets exactly as prescribed:

- Your healthcare provider will tell you how many levetiracetam tablets to take and when to take them. Levetiracetam tablets are usually taken twice a day. Take levetiracetam tablets at the same times each day.
- Your healthcare provider may change your dose. Do not change your dose without talking to your healthcare provider.
- Take levetiracetam tablets with or without food.
- Swallow the tablets whole. Do not chew or crush tablets. Ask your healthcare provider for levetiracetam oral solution if you cannot swallow tablets.
- If your healthcare provider has prescribed levetiracetam oral solution, be sure to ask your pharmacist for a medicine dropper or medicine cup to help you measure the correct amount of levetiracetam oral solution. Do not use a household teaspoon. Ask your pharmacist for instructions on how to use the measuring device the right way.
- If you miss a dose of levetiracetam tablets, take it as soon as you remember. If it is almost time for your next dose, just skip the missed dose. Take the next dose at your regular time. **Do not take two doses at the same time.**
- If you take too many levetiracetam tablets, call your local Poison Control Center or go to the nearest emergency room right away.

### **What should I avoid while taking levetiracetam tablets?**

Do not drive, operate machinery or do other dangerous activities until you know how levetiracetam tablets affect you. Levetiracetam tablets may make you dizzy or sleepy.

### **What are the possible side effects of levetiracetam tablets?**

See “What is the most important information I should know about levetiracetam tablets?”

Levetiracetam tablets can cause serious side effects.

Call your healthcare provider right away if you have any of these symptoms:

- mood and behavior changes such as aggression, agitation, anger, anxiety, apathy, mood swings, depression, hostility, and irritability. A few people may get psychotic symptoms such as hallucinations (seeing or hearing things that are really not there), delusions (false or strange thoughts or beliefs) and unusual behavior.
- extreme sleepiness, tiredness, and weakness.
- problems with muscle coordination (problems walking and moving).
- a skin rash. Serious skin rashes can happen after you start taking levetiracetam tablets. There is no way to tell if a mild rash will become a serious reaction.

The most common side effects seen in people who take levetiracetam tablets include:

- sleepiness
- weakness
- infection
- dizziness

The most common side effects seen in children who take levetiracetam tablets include, in addition to those listed above:

- tiredness
- acting aggressive
- nasal congestion
- decreased appetite
- irritability

These side effects can happen at any time but happen more often within the first 4 weeks of treatment except for infection.

Tell your healthcare provider if you have any side effect that bothers you or that does not go away.

These are not all the possible side effects of levetiracetam tablets. For more information, ask your healthcare provider or pharmacist.

**Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.**

**How should I store levetiracetam tablets?**

- Store levetiracetam tablets at 20° to 25°C (68° to 77°F).
- **Keep levetiracetam tablets and all medicines out of the reach of children.**

**General information about levetiracetam tablets.**

Medicines are sometimes prescribed for purposes other than those listed in a Medication Guide. Do not use levetiracetam tablets for a condition for which it was not prescribed. Do not give levetiracetam tablets to other people, even if they have the same symptoms that you have. It may harm them.

This Medication Guide summarizes the most important information about levetiracetam

tablets. If you would like more information, talk with your healthcare provider. You can ask your pharmacist or healthcare provider for information about levetiracetam tablets that is written for health professionals. You can also get information about levetiracetam tablets at Mylan.com or call Mylan Pharmaceuticals Inc. at 1-877-446-3679 (1-877-4-INFO-RX).

### **What are the ingredients of levetiracetam tablets?**

Active ingredient: levetiracetam.

Inactive ingredients: colloidal silicon dioxide, croscarmellose sodium, hypromellose, magnesium stearate, microcrystalline cellulose, polydextrose, polyethylene glycol, povidone, sodium lauryl sulfate, titanium dioxide and triacetin.

Levetiracetam tablets do not contain lactose or gluten.

This Medication Guide has been approved by the U.S. Food and Drug Administration.

Manufactured for:

**Mylan Pharmaceuticals Inc.**  
Morgantown, WV 26505 U.S.A.

Manufactured by:

**UNICHEM LABORATORIES LTD**  
Ind.Area, Meerut Road,  
Ghaziabad – 201 003, India  
Code No.: UP/DRUG/14/74

Distributed by:

**Mylan Institutional Inc.**  
Rockford, IL 61103 U.S.A.

**Distributed by:**  
**Cardinal Health**

Dublin, OH 43017

L41942211118

S-12257 R5

8/20

### **Package/Label Display Panel**

Levetiracetam Tablets, USP

500 mg

10 Tablets



NDC 55154-5699-0

W75

**LEVETIRACETAM TABLETS, USP**  
**500 mg**

**10 TABLETS**

Each film-coated tablet contains:

Levetiracetam, USP 500 mg

Usual Dosage: See product insert and Medication Guide  
for prescribing information, precautions and warnings

Store at 20° to 25° C (68° to 77° F)

[See USP Controlled Room Temperature]

**RX ONLY**

**WARNING:** This Unit Dose package is not child resistant  
and is intended for Institutional Use Only.  
Keep this and all drugs out of the reach of children.

Code No: USP/DRUG/14/74

Manufactured for:

Mylan Pharmaceuticals Inc.

Morgantown, WV 26505 U.S.A.

Distributed by:

Mylan Institutional Inc.

Rockford, IL 61103 U.S.A.

Made in India

Mylan.com

Mylan®

Distributed by Cardinal Health

Dublin, OH 43017

L41942211118

## LEVETIRACETAM

levetiracetam tablet, film coated

### Product Information

<b>Product Type</b>	HUMAN PRESCRIPTION DRUG	<b>Item Code (Source)</b>	NDC:55154-5699(NDC:51079- 821)
<b>Route of Administration</b>	ORAL		

### Active Ingredient/Active Moiety

<b>Ingredient Name</b>	<b>Basis of Strength</b>	<b>Strength</b>
<b>LEVETIRACETAM</b> (UNII: 44YRR34555) (LEVETIRACETAM - UNII:44YRR34555)	LEVETIRACETAM	500 mg

### Inactive Ingredients



Ingredient Name	Strength
<b>SILICON DIOXIDE</b> (UNII: ETJ7Z6XBU4)	
<b>CROSCARMELOSE SODIUM</b> (UNII: M28OL1HH48)	
<b>HYPROMELLOSE, UNSPECIFIED</b> (UNII: 3NXW29V3WO)	
<b>MAGNESIUM STEARATE</b> (UNII: 70097M6I3O)	
<b>MICROCRYSTALLINE CELLULOSE</b> (UNII: OP1R32D61U)	
<b>POLYDEXTROSE</b> (UNII: VH2XOU12IE)	
<b>POLYETHYLENE GLYCOL, UNSPECIFIED</b> (UNII: 3WJQ0SDW1A)	
<b>POVIDONE, UNSPECIFIED</b> (UNII: FZ989GH94E)	
<b>SODIUM LAURYL SULFATE</b> (UNII: 368GB5141J)	
<b>TITANIUM DIOXIDE</b> (UNII: 15FIX9V2JP)	
<b>TRIACETIN</b> (UNII: XHX3C3X673)	

### Product Characteristics

<b>Color</b>	WHITE	<b>Score</b>	2 pieces
<b>Shape</b>	OVAL (modified capsule-shaped)	<b>Size</b>	17mm
<b>Flavor</b>		<b>Imprint Code</b>	M;615
<b>Contains</b>			

### Packaging

#	Item Code	Package Description	Marketing Start Date	Marketing End Date
1	NDC:55154-5699-0	10 in 1 BAG	08/29/2012	
1		1 in 1 BLISTER PACK; Type 0: Not a Combination Product		

### Marketing Information

Marketing Category	Application Number or Monograph Citation	Marketing Start Date	Marketing End Date
ANDA	ANDA076919	08/29/2012	

**Labeler** - Cardinal Health 107, LLC (118546603)