Hemodialysis

Topiramate is cleared by hemodialysis. Using a high-efficiency, counterflow, single pass-dialysate hemodialysis procedure, topiramate dialysis clearance was 120 mL/min with blood flow through the dialyzer at 400 mL/min. This high clearance (compared to 20 to 30 mL/min total oral clearance in healthy adults) will remove a clinically significant amount of topiramate from the patient over the hemodialysis treatment period *[see Dosage and Administration (2.6), Use in Specific Populations (8.7)]*.

Hepatic Impairment

Plasma clearance of topiramate decreased a mean of 26% in patients with moderate to severe hepatic impairment.

Age, Gender, and Race

The pharmacokinetics of topiramate in elderly subjects (65 to 85 years of age, N=16) were evaluated in a controlled clinical study. The elderly subject population had reduced renal function (creatinine clearance [-20%]) compared to young adults. Following a single oral 100 mg dose, maximum plasma concentration for elderly and young adults was achieved at approximately 1 to 2 hours. Reflecting the primary renal elimination of topiramate, topiramate plasma and renal clearance were reduced 21% and 19%, respectively, in elderly subjects, compared to young adults. Similarly, topiramate half-life was longer (13%) in the elderly. Reduced topiramate clearance resulted in slightly higher maximum plasma concentration (23%) and AUC (25%) in elderly subjects than observed in young adults. Topiramate clearance is decreased in the elderly only to the extent that renal function is reduced *[see Dosage and Administration (2.4) and Use in Specific Populations (8.5)]*.

Clearance of topiramate in adults was not affected by gender or race.

Pediatric Pharmacokinetics

Pharmacokinetics of topiramate were evaluated in patients age 2 to <16 years. Patients received either no or a combination of other antiepileptic drugs. A population pharmacokinetic model was developed on the basis of pharmacokinetic data from relevant topiramate clinical studies. This dataset contained data from 1217 subjects including 258 pediatric patients age 2 to <16 years (95 pediatric patients <10 years of age).

Pediatric patients on adjunctive treatment exhibited a higher oral clearance (L/h) of topiramate compared to patients on monotherapy, presumably because of increased clearance from concomitant enzyme-inducing antiepileptic drugs. In comparison, topiramate clearance per kg is greater in pediatric patients than in adults and in young pediatric patients (down to 2 years) than in older pediatric patients. Consequently, the plasma drug concentration for the same mg/kg/day dose would be lower in pediatric patients compared to adults and also in younger pediatric patients compared to older pediatric patients. Clearance was independent of dose.

As in adults, hepatic enzyme-inducing antiepileptic drugs decrease the steady state plasma concentrations of topiramate.

Drug Interactions

In vitro studies indicate that topiramate does not inhibit CYP1A2, CYP2A6, CYP2B6, CYP2C9, CYP2D6, CYP2E1, or CYP3A4/5 isozymes. *In vitro* studies indicate that topiramate is a mild inhibitor of CYP2C19 and a mild inducer of CYP3A4.

Antiepileptic Drugs

Potential interactions between topiramate and standard AEDs were assessed in controlled clinical pharmacokinetic studies in patients with epilepsy. The effects of these interactions on mean plasma AUCs are summarized in Table 11.

In Table 11, the second column (AED concentration) describes what happens to the concentration of the co-administered AED listed in the first column when topiramate is added. The third column (topiramate concentration) describes how the co-administration of a drug listed in the first column modifies the concentration of topiramate when compared to TOPAMAX® given alone.

Table 11: Summary of AED Interactions with TOPAMAX®

AED Co-administered	AED Concentration	Topiramate Concentration
Phenytoin	NC or 25% increase[a]	48% decrease
Carbamazepine (CBZ)	NC	40% decrease
CBZ epoxide[b]	NC	NE
Valproic acid	11% decrease	14% decrease
Phenobarbital	NC	NE
Primidone	NC	NE
Lamotrigine	NC at TPM doses up to 400 mg/day	13% decrease

[a] = Plasma concentration increased 25% in some patients, generally those on a twice a day dosing regimen of phenytoin.
[b] = Is not administered but is an active metabolite of carbamazepine.
NC = Less than 10% change in plasma concentration.
AED = Antiepileptic drug.
NE = Not Evaluated.
TPM = Topiramate

Oral Contraceptives

In a pharmacokinetic interaction study in healthy volunteers with a concomitantly administered combination oral contraceptive product containing 1 mg norethindrone (NET) plus 35 mcg ethinyl estradiol (EE), TOPAMAX®, given in the absence of other medications at doses of 50 to 200 mg/day, was not associated with statistically significant changes in mean exposure (AUC) to

either component of the oral contraceptive. In another study, exposure to EE was statistically significantly decreased at doses of 200, 400, and 800 mg/day (18%, 21%, and 30%, respectively) when given as adjunctive therapy in patients taking valproic acid. In both studies, TOPAMAX® (50 mg/day to 800 mg/day) did not significantly affect exposure to NET and there was no significant dose-dependent change in EE exposure for doses of 50 to 200 mg/day. The clinical significance of the changes observed is not known *[see Drug Interactions (7.4)]*.

Digoxin

In a single-dose study, serum digoxin AUC was decreased by 12% with concomitant TOPAMAX® administration. The clinical relevance of this observation has not been established.

Hydrochlorothiazide

A drug interaction study conducted in healthy volunteers evaluated the steady-state pharmacokinetics of hydrochlorothiazide (HCTZ) (25 mg every 24 hours) and topiramate (96 mg every 12 hours) when administered alone and concomitantly. The results of this study indicate that topiramate C_{max} increased by 27% and AUC increased by 29% when HCTZ was added to topiramate. The clinical significance of this change is unknown. The steady-state pharmacokinetics of HCTZ were not significantly influenced by the concomitant administration of topiramate. Clinical laboratory results indicated decreases in serum potassium after topiramate or HCTZ administration, which were greater when HCTZ and topiramate were administered in combination.

Metformin

A drug interaction study conducted in healthy volunteers evaluated the steady-state pharmacokinetics of metformin (500 mg every 12 hours) and topiramate in plasma when metformin was given alone and when metformin and topiramate (100 mg every 12 hours) were given simultaneously. The results of this study indicated that the mean metformin C_{max} and AUC_{0-12h} increased by 18% and 25%, respectively, when topiramate was added. Topiramate did not affect metformin t_{max}. The clinical significance of the effect of topiramate on metformin pharmacokinetics is not known. Oral plasma clearance of topiramate appears to be reduced when administered with metformin. The clinical significance of the effect of metformin on topiramate pharmacokinetics is unclear.

Pioglitazone

A drug interaction study conducted in healthy volunteers evaluated the steady-state pharmacokinetics of topiramate and pioglitazone when administered alone and concomitantly. A 15% decrease in the $AUC_{\tau,ss}$ of pioglitazone with no alteration in $C_{max,ss}$ was observed. This finding was not statistically significant. In addition, a 13% and 16% decrease in $C_{max,ss}$ and $AUC_{\tau,ss}$ respectively, of the active hydroxy-metabolite was noted as well as a 60% decrease in $C_{max,ss}$ and $AUC_{\tau,ss}$ of the active keto-metabolite. The clinical significance of these findings is not known.

Glyburide

A drug-drug interaction study conducted in patients with type 2 diabetes evaluated the steady-state pharmacokinetics of glyburide (5 mg/day) alone and concomitantly with topiramate (150 mg/day). There was a 22% decrease in C_{max} and a 25% reduction in AUC_{24} for glyburide during topiramate administration. Systemic exposure (AUC) of the active metabolites, 4-*trans*-hydroxy-glyburide (M1) and 3-*cis*-hydroxyglyburide (M2), was also reduced by 13% and 15%, and C_{max} was reduced by 18% and 25%, respectively. The steady-state pharmacokinetics of topiramate were unaffected by concomitant administration of glyburide.

Lithium

In patients, the pharmacokinetics of lithium were unaffected during treatment with topiramate at doses of 200 mg/day; however, there was an observed increase in systemic exposure of lithium (27% for C_{max} and 26% for AUC) following topiramate doses up to 600 mg/day *[see Drug Interactions (7.7)]*.

Haloperidol

The pharmacokinetics of a single dose of haloperidol (5 mg) were not affected following multiple dosing of topiramate (100 mg every 12 hr) in 13 healthy adults (6 males, 7 females).

Amitriptyline

There was a 12% increase in AUC and C_{max} for amitriptyline (25 mg per day) in 18 healthy subjects (9 males, 9 females) receiving 200 mg/day of TOPAMAX®.

Sumatriptan

Multiple dosing of topiramate (100 mg every 12 hours) in 24 healthy volunteers (14 males, 10 females) did not affect the pharmacokinetics of single-dose sumatriptan either orally (100 mg) or subcutaneously (6 mg).

Risperidone

When administered concomitantly with topiramate at escalating doses of 100, 250, and 400 mg/day, there was a reduction in risperidone systemic exposure (16% and 33% for steady-state AUC at the 250 and 400 mg/day doses of topiramate). No alterations of 9-hydroxyrisperidone levels were observed. Co-administration of topiramate 400 mg/day with risperidone resulted in a 14% increase in C_{max} and a 12% increase in AUC_{12} of topiramate. There were no clinically significant changes in the systemic exposure of risperidone plus 9-hydroxyrisperidone or of topiramate; therefore, this interaction is not likely to be of clinical significance.

Propranolol

Multiple dosing of topiramate (200 mg/day) in 34 healthy volunteers (17 males, 17 females) did not affect the pharmacokinetics of propranolol following daily 160 mg doses. Propranolol doses of 160 mg/day in 39 volunteers (27 males, 12 females) had no effect on the exposure to topiramate, at a dose of 200 mg/day of topiramate.

Dihydroergotamine

Multiple dosing of topiramate (200 mg/day) in 24 healthy volunteers (12 males, 12 females) did not affect the pharmacokinetics of a 1 mg subcutaneous dose of dihydroergotamine. Similarly, a 1 mg subcutaneous dose of dihydroergotamine did not affect the pharmacokinetics of a 200 mg/day dose of topiramate in the same study.

Diltiazem

Co-administration of diltiazem (240 mg Cardizem CD®) with topiramate (150 mg/day) resulted in a 10% decrease in C_{max} and a 25% decrease in diltiazem AUC, a 27% decrease in C_{max} and an 18% decrease in des-acetyl diltiazem AUC, and no effect on N-desmethyl diltiazem. Co-administration of topiramate with diltiazem resulted in a 16% increase in C_{max} and a 19% increase in AUC_{12} of topiramate.

Venlafaxine

Multiple dosing of TOPAMAX® (150 mg/day) in healthy volunteers did not affect the pharmacokinetics of venlafaxine or O-desmethyl venlafaxine. Multiple dosing of venlafaxine (150 mg) did not affect the pharmacokinetics of topiramate.

13 NON-CLINICAL TOXICOLOGY

13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

Carcinogenesis

An increase in urinary bladder tumors was observed in mice given topiramate (0, 20, 75, and 300 mg/kg/day) in the diet for 21 months. The increase in the incidence of bladder tumors in males and females receiving 300 mg/kg/day was primarily due to the increased occurrence of a smooth muscle tumor considered histomorphologically unique to mice. The higher of the doses not associated with an increase in tumors (75 mg/kg/day) is equivalent to the maximum recommended human dose (MRHD) for epilepsy (400 mg), and approximately 4 times the MRHD for migraine (100 mg) on a mg/m^2 basis. The relevance of this finding to human carcinogenic risk is uncertain. No evidence of carcinogenicity was seen in rats following oral administration of topiramate for 2 years at doses up to 120 mg/kg/day (approximately 3 times the MRHD for epilepsy and 12 times the MRHD for migraine on a mg/m^2 basis).

Mutagenesis

Topiramate did not demonstrate genotoxic potential when tested in a battery of *in vitro* and *in vivo* assays. Topiramate was not mutagenic in the Ames test or the *in vitro* mouse lymphoma assay; it did not increase unscheduled DNA synthesis in rat hepatocytes *in vitro*; and it did not increase chromosomal aberrations in human lymphocytes *in vitro* or in rat bone marrow *in vivo*.

Impairment of Fertility

No adverse effects on male or female fertility were observed in rats administered topiramate orally at doses up to 100 mg/kg/day (2.5 times the MRHD for epilepsy and 10 times the MRHD for migraine on a mg/m^2 basis) prior to and during mating and early pregnancy.

14 CLINICAL STUDIES

The studies described in the following sections were conducted using TOPAMAX® (topiramate) Tablets.

14.1 Monotherapy Epilepsy

Patients with Partial-Onset or Primary Generalized Tonic-Clonic Seizures

Adults and Pediatric Patients 10 Years of Age and Older

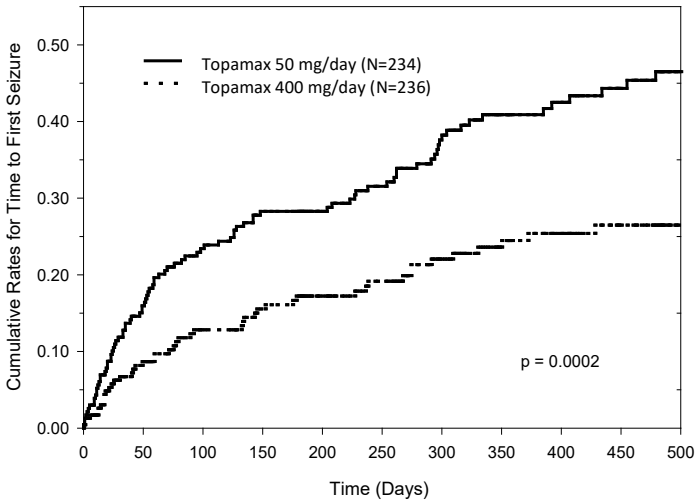
The effectiveness of TOPAMAX® as initial monotherapy in adults and pediatric patients 10 years of age and older with partial-onset or primary generalized tonic-clonic seizures was established in a multicenter, randomized, double-blind, parallel-group trial (Study 1).

Study 1 was conducted in 487 patients diagnosed with epilepsy (6 to 83 years of age) who had 1 or 2 well-documented seizures during the 3-month retrospective baseline phase who then entered the study and received TOPAMAX® 25 mg/day for 7 days in an open-label fashion. Forty-nine percent of patients had no prior AED treatment and 17% had a diagnosis of epilepsy for greater than 24 months. Any AED therapy used for temporary or emergency purposes was discontinued prior to randomization. In the double-blind phase, 470 patients were randomized to titrate up to 50 mg/day or 400 mg/day. If the target dose could not be achieved, patients were maintained on the maximum tolerated dose. Fifty-eight percent of patients achieved the maximal dose of 400 mg/day for >2 weeks, and patients who did not tolerate 150 mg/day were discontinued.

The primary efficacy assessment was a between-group comparison of time to first seizure during the double-blind phase. Comparison of the Kaplan-Meier survival curves of time to first seizure favored the TOPAMAX® 400 mg/day group over the TOPAMAX® 50 mg/day group (Figure 1). The treatment effects with respect to time to first seizure were consistent across various patient subgroups defined by age, sex, geographic region, baseline body weight, baseline seizure type, time since diagnosis, and baseline AED use.

Figure 1: Kaplan-Meier Estimates of Cumulative Rates for Time to First

Seizure in Study 1



Pediatric Patients 2 to 9 Years of Age

The conclusion that TOPAMAX® is effective as initial monotherapy in pediatric patients 2 to 9 years of age with partial-onset or primary generalized tonic-clonic seizures was based on a pharmacometric bridging approach using data from the controlled epilepsy trials described in labeling. This approach consisted of first showing a similar exposure response relationship between pediatric patients down to 2 years of age and adults when TOPAMAX® was given as adjunctive therapy. Similarity of exposure-response was also demonstrated in pediatric patients 6 to less than 16 years of age and adults when TOPAMAX® was given as initial monotherapy. Specific dosing in pediatric patients 2 to 9 years of age was derived from simulations utilizing plasma exposure ranges observed in pediatric and adult patients treated with TOPAMAX® initial monotherapy *[see Dosage and Administration (2.1)]*.

14.2 Adjunctive Therapy Epilepsy

Adult Patients With Partial-Onset Seizures

The effectiveness of TOPAMAX® as an adjunctive treatment for adults with partial-onset seizures was established in six multicenter, randomized, double-blind, placebo-controlled trials (Studies 2, 3, 4, 5, 6, and 7), two comparing several dosages of TOPAMAX® and placebo and four comparing a single dosage with placebo, in patients with a history of partial-onset seizures, with or without secondarily generalized seizures.

Patients in these studies were permitted a maximum of two antiepileptic drugs (AEDs) in addition to TOPAMAX® tablets or placebo. In each study, patients were stabilized on optimum dosages of their concomitant AEDs during baseline phase lasting between 4 and 12 weeks. Patients who experienced a pre-specified minimum number of partial-onset seizures, with or without secondary generalization, during the baseline phase (12 seizures for 12-week baseline, 8 for 8-week baseline or 3 for 4-week baseline) were randomly assigned to placebo or a specified dose of TOPAMAX® tablets in addition to their other AEDs.

Following randomization, patients began the double-blind phase of treatment. In five of the six studies, patients received active drug beginning at 100 mg per day; the dose was then increased by 100 mg or 200 mg/day increments weekly or every other week until the assigned dose was reached, unless intolerance prevented increases. In the sixth study (Study 7), the 25 or 50 mg/day initial doses of topiramate were followed by respective weekly increments of 25 or 50 mg/day until the target dose of 200 mg/day was reached. After titration, patients entered a 4, 8 or 12-week stabilization period. The numbers of patients randomized to each dose and the actual mean and median doses in the stabilization period are shown in Table 12.

Pediatric Patients 2 to 16 Years of Age with Partial-Onset Seizures

The effectiveness of TOPAMAX® as an adjunctive treatment for pediatric patients 2 to 16 years of age with partial-onset seizures was established in a multicenter, randomized, double-blind, placebo-controlled trial (Study 8), comparing TOPAMAX® and placebo in patients with a history of partial-onset seizures, with or without secondarily generalized seizures (see Table 13).

Patients in this study were permitted a maximum of two antiepileptic drugs (AEDs) in addition to TOPAMAX® tablets or placebo. In this study, patients were stabilized on optimum dosages of their concomitant AEDs during an 8-week baseline phase. Patients who experienced at least six partial-onset seizures, with or without secondarily generalized seizures, during the baseline phase were randomly assigned to placebo or TOPAMAX® tablets in addition to their other AEDs.

Following randomization, patients began the double-blind phase of treatment. Patients received active drug beginning at 25 or 50 mg/day; the dose was then increased by 25 mg to 150 mg/day increments every other week until the assigned dosage of 125, 175, 225, or 400 mg/day based on patients' weight to approximate a dosage of 6 mg/kg/day was reached, unless intolerance prevented increases. After titration, patients entered an 8-week stabilization period.

Patients With Primary Generalized Tonic-Clonic Seizures

The effectiveness of TOPAMAX® as an adjunctive treatment for primary generalized tonic-clonic seizures in patients 2 years of age and older was established in a multicenter, randomized, double-blind, placebo-controlled trial (Study 9), comparing a single dosage of TOPAMAX® and placebo (see Table 13).

Patients in Study 9 were permitted a maximum of two antiepileptic drugs (AEDs) in addition to TOPAMAX® or placebo. Patients were stabilized on optimum dosages of their concomitant AEDs during an 8-week baseline phase. Patients who experienced at least three primary generalized tonic-clonic seizures during the baseline phase were randomly assigned to placebo or TOPAMAX® in addition to their other AEDs.

Following randomization, patients began the double-blind phase of treatment. Patients received active drug beginning at 50 mg/day for four weeks; the dose was then increased by 50 mg to 150 mg/day increments every other week until the assigned dose of 175, 225, or 400 mg/day based

on patients' body weight to approximate a dosage of 6 mg/kg/day was reached, unless intolerance prevented increases. After titration, patients entered a 12-week stabilization period.

Patients With Lennox-Gastaut Syndrome

The effectiveness of TOPAMAX® as an adjunctive treatment for seizures associated with Lennox-Gastaut syndrome was established in a multicenter, randomized, double-blind, placebo-controlled trial (Study 10) comparing a single dosage of TOPAMAX® with placebo in patients 2 years of age and older (see Table 13).

Patients in Study 10 were permitted a maximum of two antiepileptic drugs (AEDs) in addition to TOPAMAX® or placebo. Patients who were experiencing at least 60 seizures per month before study entry were stabilized on optimum dosages of their concomitant AEDs during a 4-week baseline phase. Following baseline, patients were randomly assigned to placebo or TOPAMAX® in addition to their other AEDs. Active drug was titrated beginning at 1 mg/kg/day for a week; the dose was then increased to 3 mg/kg/day for one week, then to 6 mg/kg/day. After titration, patients entered an 8-week stabilization period.

The primary measures of effectiveness were the percent reduction in drop attacks and a parental global rating of seizure severity.

Table 12: TOPAMAX® Dose Summary During the Stabilization Periods of Each of Six Double-Blind, Placebo-Controlled, Adjunctive Trials in Adults with Partial-Onset Seizures[a]

			Target TOPAMAX® Dosage (mg/day)				
Study	**Stabilization Dose**	**Placebo[b]**	**200**	**400**	**600**	**800**	**1,000**
2	N	42	42	40	41	--	--
	Mean Dose	5.9	200	390	556	--	--
	Median Dose	6.0	200	400	600	--	--
3	N	44	--	--	40	45	40
	Mean Dose	9.7	--	--	544	739	796
	Median Dose	10.0	--	--	600	800	1,000
4	N	23	--	19	--	--	--
	Mean Dose	3.8	--	395	--	--	--
	Median Dose	4.0	--	400	--	--	--
5	N	30	--	--	28	--	--
	Mean Dose	5.7	--	--	522	--	--
	Median Dose	6.0	--	--	600	--	--
6	N	28	--	--	--	25	--
	Mean Dose	7.9	--	--	--	568	--
	Median Dose	8.0	--	--	--	600	--
7	N	90	157	--	--	--	--
	Mean Dose	8	200	--	--	--	--
	Median Dose	8	200	--	--	--	--

[a] Dose-response studies were not conducted for other indications or pediatric partial-onset seizures.

[b] Placebo dosages are given as the number of tablets. Placebo target dosages were as follows: Protocol 3 4 tablets/day; Protocols 1 and 4, 6 tablets/day; Protocols 5 and 6, 8 tablets/day; Protocol 2, 10 tablets/day.

In all adjunctive trials, the reduction in seizure rate from baseline during the entire double-blind phase was measured. The median percent reductions in seizure rates and the responder rates (fraction of patients with at least a 50% reduction) by treatment group for each study are shown below in Table 13. As described above, a global improvement in seizure severity was also assessed in the Lennox-Gastaut trial.

Table 13: Efficacy Results in Double-Blind, Placebo-Controlled, Adjunctive Epilepsy Trials

		Target TOPAMAX Dosage (mg per day)						
Study #	**#**	**Placebo**	**200**	**400**	**600**	**800**	**1,000**	**≈6mg/ kg/day***
Partial-Onset Seizures Studies in Adults								
2	N	45	45	45	46	--	--	--
	Median % Reduction	12	27[a]	48[b]	45[c]	--	--	--
	% Responders	18	24	44[d]	46[d]	--	--	--
3	N	47	--	--	48	48	47	--
	Median % Reduction	2	--	--	41[c]	41[c]	36[c]	
	% Responders	9	--	--	40[c]	41[c]	36[d]	
4	N	24	--	23	--	--	--	--
	Median % Reduction	1	--	41[e]	--	--	--	--
	% Responders	8	--	35[d]	--	--	--	--
5	N	30	--	--	30	--	--	--
	Median % Reduction	-12	--	--	46[f]	--	--	--
	% Responders	10	--	--	47[c]	--	--	--
6	N	28	--	--	--	28	--	--
	Median % Reduction	-21	--	--	--	24[c]	--	--
	% Responders	0	--	--	--	43[c]	--	--
7	N	91	168	--	--	--	--	--
	Median % Reduction	20	44[c]	--	--	--	--	--
	% Responders	24	45[c]					
Partial-Onset Seizures Studies in Pediatric Patients								
8	N	45	--	--	--	--	--	41
	Median % Reduction	11	--	--	--	--	--	33[d]
	% Responders	20	--	--	--	--	--	39
Primary Generalized Tonic-Clonic[h],								
9	N	40	--	--	--	--	--	39
	Median % Reduction	9	--	--	--	--	--	57[d]
	% Responders	20	--	--	--	--	--	56[c]
Lennox-Gastaut Syndrome[i],								
10	N	49	--	--	--	--	--	46
	Median % Reduction	-5	--	--	--	--	--	15[d]
	% Responders	14						28[g]
	Improvement in Seizure Severity[j]	28						52d

Comparisons with placebo: [a]p=0.080; [b]p ≤ 0.010; [c]p ≤ 0.001; [d]p ≤ 0.050; [e]p=0.065; [f]p ≤0.005; [g]p=0.071;
[h]Median % reduction and % responders are reported for PGTC seizures;
[i]Median % reduction and % responders for drop attacks, i.e., tonic or atonic seizures
[j]Percentage of subjects who were minimally, much, or very much improved from baseline.

*For Studies 8 and 9, specified target dosages (<9.3 mg/kg/day) were assigned based on subject's weight to approximate a dosage of 6mg/kg per day; these dosages corresponded to mg/day dosages of 125, 175, 225, and 400 mg/day

Subset analyses of the antiepileptic efficacy of TOPAMAX® tablets in these studies showed no differences as a function of gender, race, age, baseline seizure rate, or concomitant AED.

In clinical trials for epilepsy, daily dosages were decreased in weekly intervals by 50 to 100 mg/day in adults and over a 2- to 8-week period in pediatric patients; transition was permitted to a new antiepileptic regimen when clinically indicated.

14.3 Preventive Treatment of Migraine

Adult Patients

The results of 2 multicenter, randomized, double-blind, placebo-controlled, parallel-group clinical trials established the effectiveness of TOPAMAX® in the preventive treatment of migraine. The design of both trials (Study 11 was conducted in the U.S. and Study 12 was conducted in the U.S. and Canada) was identical, enrolling patients with a history of migraine, with or without aura, for at least 6 months, according to the International Headache Society (IHS) diagnostic criteria. Patients with a history of cluster headaches or basilar, ophthalmoplegic, hemiplegic, or transformed migraine headaches were excluded from the trials. Patients were required to have completed up to a 2-week washout of any prior migraine preventive medications before starting the baseline phase.

Patients who experienced 3 to 12 migraine headaches over the 4 weeks in the baseline phase were randomized to either TOPAMAX® 50 mg/day, 100 mg/day, 200 mg/day, or placebo and treated for a total of 26 weeks (8-week titration period and 18-week maintenance period). Treatment was initiated at 25 mg/day for one week, and then the daily dosage was increased by 25 mg increments each week until reaching the assigned target dose or maximum tolerated dose (administered twice daily).

Effectiveness of treatment was assessed by the reduction in migraine headache frequency, as measured by the change in 4-week migraine rate (according to migraines classified by IHS criteria) from the baseline phase to double-blind treatment period in each TOPAMAX® treatment group compared to placebo in the Intent-To-Treat (ITT) population.

In Study 11, a total of 469 patients (416 females, 53 males), ranging in age from 13 to 70 years, were randomized and provided efficacy data. Two hundred sixty-five patients completed the entire 26-week double-blind phase. The median average daily dosages were 48 mg/day, 88 mg/day, and 132 mg/day in the target dose groups of TOPAMAX® 50, 100, and 200 mg/day, respectively.

The mean migraine headache frequency rate at baseline was approximately 5.5 migraine headaches/28 days and was similar across treatment groups. The change in the mean 4-week migraine headache frequency from baseline to the double-blind phase was -1.3, -2.1, and -2.2 in the TOPAMAX® 50, 100, and 200 mg/day groups, respectively, versus -0.8 in the placebo group

(see Figure 2). The treatment differences between the TOPAMAX® 100 and 200 mg/day groups versus placebo were similar and statistically significant ($p<0.001$ for both comparisons).

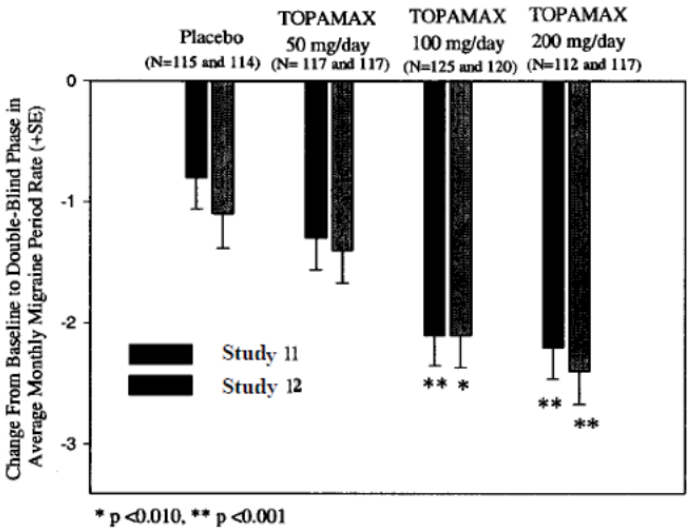
In Study 12, a total of 468 patients (406 females, 62 males), ranging in age from 12 to 65 years, were randomized and provided efficacy data. Two hundred fifty-five patients completed the entire 26-week double-blind phase. The median average daily dosages were 47 mg/day, 86 mg/day, and 150 mg/day in the target dose groups of TOPAMAX® 50, 100, and 200 mg/day, respectively.

The mean migraine headache frequency rate at baseline was approximately 5.5 migraine headaches/28 days and was similar across treatment groups. The change in the mean 4-week migraine headache period frequency from baseline to the double-blind phase was -1.4, -2.1, and -2.4 in the TOPAMAX® 50, 100, and 200 mg/day groups, respectively, versus -1.1 in the placebo group (see Figure 2). The differences between the TOPAMAX® 100 and 200 mg/day groups versus placebo were similar and statistically significant ($p=0.008$ and $p <0.001$, respectively).

In both studies, there were no apparent differences in treatment effect within age or gender subgroups. Because most patients were Caucasian, there were insufficient numbers of patients from different races to make a meaningful comparison of race.

For patients withdrawing from TOPAMAX®, daily dosages were decreased in weekly intervals by 25 to 50 mg/day.

Figure 2: Reduction in 4-Week Migraine Headache Frequency
(Studies 11 and 12 for Adults and Adolescents)



Pediatric Patients 12 to 17 Years of Age

The effectiveness of TOPAMAX® for the preventive treatment of migraine in pediatric patients 12 to 17 years of age was established in a multicenter, randomized, double-blind, parallel-group trial (Study 13). The study enrolled 103 patients (40 male, 63 female) 12 to 17 years of age with episodic migraine headaches with or without aura. Patient selection was based on IHS criteria for migraines (using proposed revisions to the 1988 IHS pediatric migraine criteria [IHS-R criteria]).

Patients who experienced 3 to 12 migraine attacks (according to migraines classified by patient reported diaries) and ≤14 headache days (migraine and non-migraine) during the 4-week prospective baseline period were randomized to either TOPAMAX® 50 mg/day, 100 mg/day, or placebo and treated for a total of 16 weeks (4-week titration period followed by a 12-week maintenance period). Treatment was initiated at 25 mg/day for one week, and then the daily dosage was increased by 25 mg increments each week until reaching the assigned target dose or maximum tolerated dose (administered twice daily). Approximately 80% or more patients in each treatment group completed the study. The median average daily dosages were 45 and 79 mg/day in the target dose groups of TOPAMAX® 50 and 100 mg/day, respectively.

Effectiveness of treatment was assessed by comparing each TOPAMAX® treatment group to placebo (ITT population) for the percent reduction from baseline to the last 12 weeks of the double-blind phase in the monthly migraine attack rate (primary endpoint). The percent reduction from baseline to the last 12 weeks of the double-blind phase in average monthly migraine attack rate is shown in Table 14. The 100 mg TOPAMAX® dose produced a statistically significant treatment difference relative to placebo of 28% reduction from baseline in the monthly migraine attack rate.

The mean reduction from baseline to the last 12 weeks of the double-blind phase in average monthly attack rate, a key secondary efficacy endpoint in Study 13 (and the primary efficacy endpoint in Studies 11 and 12, of adults) was 3.0 for 100 mg TOPAMAX® dose and 1.7 for placebo. This 1.3 treatment difference in mean reduction from baseline of monthly migraine rate was statistically significant ($p = 0.0087$).

Table 14: Percent Reduction from Baseline to the Last 12 Weeks of Double-Blind Phase in Average Monthly Attack Rate: Study 13 (Intent-to-Treat Analysis Set)

Category	Placebo (N=33)	TOPAMAX® 50 mg/day (N=35)	TOPAMAX® 100 mg/day (N=35)
Baseline			
Median	3.6	4.0	4.0
Last 12 Weeks of Double-Blind Phase			
Median	2.3	2.3	1.0
Percent Reduction (%)			
Median	44.4	44.6	72.2
P-value versus Placebo[a,b]		0.7975	0.0164 [c]

[a] P-values (two-sided) for comparisons relative to placebo are generated by applying an ANCOVA model on ranks that includes subject's stratified age at baseline, treatment group, and analysis center as factors and monthly migraine attack rate during baseline period as a covariate.

[b] P-values for the dose groups are the adjusted p-value according to the Hochberg multiple comparison procedure.

[c] Indicates p-value is <0.05 (two-sided).

16 HOW SUPPLIED/STORAGE AND HANDLING

16.1 How Supplied

TOPAMAX® Tablets

TOPAMAX® (topiramate) Tablets are available as debossed, coated, round tablets in the following strengths and colors:

- 25 mg cream tablet (debossed “OMN” on one side; "25" on the other) and are available in bottles of 60 count with desiccant (NDC 50458-639-65)
- 50 mg light yellow tablet (debossed “OMN” on one side; "50" on the other) and are available in bottles of 60 count with desiccant (NDC 50458-640-65)
- 100 mg yellow tablet (debossed “OMN” on one side; "100" on the other) and are available in bottles of 60 count with desiccant (NDC 50458-641-65)
- 200 mg salmon tablet (debossed “OMN” on one side; "200" on the other) and are available in bottles of 60 count with desiccant (NDC 50458-642-65)

TOPAMAX® Sprinkle Capsules

TOPAMAX® (topiramate capsules) Sprinkle Capsules contain small, white to off-white spheres. The gelatin capsules are white and clear and are marked as follows:

- 15 mg capsule with “TOP” and “15 mg” on the side and are available in bottles of 60 (NDC 50458-647-65)

- 25 mg capsule with “TOP” and “25 mg” on the side and are available in bottles of 60 (NDC 50458-645-65)

16.2 Storage and Handling

TOPAMAX® Tablets

TOPAMAX® Tablets should be stored in tightly-closed containers at controlled room temperature (59° to 86°F, 15° to 30°C). Protect from moisture.

TOPAMAX® Sprinkle Capsules

TOPAMAX® Sprinkle Capsules should be stored in tightly-closed containers at or below 25°C (77°F). Protect from moisture.

17 PATIENT COUNSELING INFORMATION

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

Eye Disorders

Instruct patients taking TOPAMAX® to seek immediate medical attention if they experience blurred vision, visual disturbances, or periorbital pain *[see Warnings and Precautions (5.1, 5.2)]*.

Oligohidrosis and Hyperthermia

Closely monitor TOPAMAX®-treated patients, especially pediatric patients, for evidence of decreased sweating and increased body temperature, especially in hot weather. Counsel patients to contact their healthcare professionals immediately if they develop a high or persistent fever, or decreased sweating *[see Warnings and Precautions (5.3)]*.

Metabolic Acidosis

Warn patients about the potential significant risk for metabolic acidosis that may be asymptomatic and may be associated with adverse effects on kidneys (e.g., kidney stones, nephrocalcinosis), bones (e.g., osteoporosis, osteomalacia, and/or rickets in children), and growth (e.g., growth delay/retardation) in pediatric patients, and on the fetus *[see Warnings and Precautions (5.4), Use in Specific Populations (8.1)]*.

Suicidal Behavior and Ideation

Counsel patients, their caregivers, and families that AEDs, including TOPAMAX®, may increase the risk of suicidal thoughts and behavior, and advise 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, or behavior or thoughts about self-harm. Instruct patients to immediately report behaviors of concern to their healthcare providers *[see Warnings and Precautions (5.5)]*.

Interference with Cognitive and Motor Performance

Warn patients about the potential for somnolence, dizziness, confusion, difficulty concentrating, or visual effects, and advise patients not to drive or operate machinery until they have gained sufficient experience on TOPAMAX® to gauge whether it adversely affects their mental performance, motor performance, and/or vision *[see Warnings and Precautions (5.6)]*.

Even when taking TOPAMAX® or other anticonvulsants, some patients with epilepsy will continue to have unpredictable seizures. Therefore, advise all patients taking TOPAMAX® for epilepsy to exercise appropriate caution when engaging in any activities where loss of consciousness could result in serious danger to themselves or those around them (including swimming, driving a car, climbing in high places, etc.). Some patients with refractory epilepsy will need to avoid such activities altogether. Discuss the appropriate level of caution with patients, before patients with epilepsy engage in such activities.

Fetal Toxicity

Inform pregnant women and women of childbearing potential that use of TOPAMAX® during pregnancy can cause fetal harm. Topamax increases the risk of major congenital malformations, including but not limited to cleft lip and/or cleft palate (oral clefts), which occur early in pregnancy before many women know they are pregnant. Also inform patients that infants exposed to topiramate monotherapy *in utero* may be SGA *[see Use in Specific Populations (8.1)]*. There may also be risks to the fetus from chronic metabolic acidosis with use of TOPAMAX® during pregnancy *[see Warnings and Precautions (5.7), Use in Specific Populations (8.1)]*. When appropriate, counsel pregnant women and women of childbearing potential about alternative therapeutic options.

Advise women of childbearing potential who are not planning a pregnancy to use effective contraception while using TOPAMAX®, keeping in mind that there is a potential for decreased contraceptive efficacy when using estrogen-containing birth control with topiramate *[see Drug Interactions (7.4)]*.

Encourage pregnant women using TOPAMAX®, to enroll in the North American Antiepileptic Drug (NAAED) Pregnancy Registry. The registry is collecting information about the safety of antiepileptic drugs during pregnancy *[see Use in Specific Populations (8.1)]*.

Decrease in Bone Mineral Density

Inform the patient or caregiver that long-term treatment with TOPAMAX® can decrease bone formation and increase bone resorption in children *[see Warnings and Precautions (5.9)]*.

Negative Effects on Growth (Height and Weight)

Discuss with the patient or caregiver that long-term TOPAMAX® treatment may attenuate growth as reflected by slower height increase and weight gain in pediatric patients *[see Warnings and Precautions (5.10)]*.

Serious Skin Reactions

Inform patients about the signs of serious skin reactions. Instruct patients to immediately inform their healthcare provider at the first appearance of skin rash *[see Warnings and Precautions (5.11)]*.

Hyperammonemia and Encephalopathy

Warn patients about the possible development of hyperammonemia with or without encephalopathy. Although hyperammonemia may be asymptomatic, clinical symptoms of hyperammonemic encephalopathy often include acute alterations in level of consciousness and/or cognitive function with lethargy and/or vomiting. This hyperammonemia and encephalopathy can develop with TOPAMAX® treatment alone or with TOPAMAX® treatment with concomitant valproic acid (VPA).

Instruct patients to contact their physician if they develop unexplained lethargy, vomiting, or changes in mental status *[see Warnings and Precautions (5.12)]*.

Kidney Stones

Instruct patients, particularly those with predisposing factors, to maintain an adequate fluid intake in order to minimize the risk of kidney stone formation *[see Warnings and Precautions (5.13)]*.

Instructions for a Missing Dose

Instruct patients that if they miss a single dose of TOPAMAX®, it should be taken as soon as possible. However, if a patient is within 6 hours of taking the next scheduled dose, tell the patient to wait until then to take the usual dose of TOPAMAX®, and to skip the missed dose. Tell patients that they should not take a double dose in the event of a missed dose. Advise patients to contact their healthcare provider if they have missed more than one dose.

Manufactured by:

Janssen Ortho LLC

Gurabo, Puerto Rico 00778

Manufactured for:

Janssen Pharmaceuticals, Inc.

Titusville, NJ 08560

- **Effects on thinking and alertness.** TOPAMAX may affect how you think and cause confusion, problems with concentration, attention, memory, or speech. TOPAMAX may cause depression or mood problems, tiredness, and sleepiness.
- **Dizziness or loss of muscle coordination.**
- **Serious skin reactions.** TOPAMAX may cause a severe rash with blisters and peeling skin, especially around the mouth, nose, eyes, and genitals (Stevens-Johnson syndrome). TOPAMAX may also cause a rash with blisters and peeling skin over much of the body that may cause death (toxic epidermal necrolysis). Call your healthcare provider right away if you develop a skin rash or blisters.
- **Kidney stones.** Drink plenty of fluids when taking TOPAMAX to decrease your chances of getting kidney stones.
- **Low body temperature.** Taking TOPAMAX when you are also taking valproic acid can cause a drop in body temperature to less than 95°F, or can cause tiredness, confusion, or coma.

Call your healthcare provider right away if you have any of the symptoms above.

The most common side effects of TOPAMAX include:

- tingling of the arms and legs (paresthesia)
- not feeling hungry
- nausea
- a change in the way foods taste
- diarrhea
- weight loss
- nervousness
- upper respiratory tract infection
- speech problems
- tiredness
- dizziness
- sleepiness/drowsiness
- slow reactions
- difficulty with memory
- pain in the abdomen
- fever
- abnormal vision
- decreased feeling or sensitivity, especially in the skin

Tell your healthcare provider about any side effect that bothers you or that does not go away. These are not all the possible side effects of TOPAMAX. Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088. You may also report side effects to Janssen Pharmaceuticals, Inc. at 1-800-JANSSEN (1-800-526-7736).

How should I store TOPAMAX?

- Store TOPAMAX Tablets at room temperature between 59°F to 86°F (15°C to 30°C).
- Store TOPAMAX Sprinkle Capsules at or below 77°F (25°C).
- Keep TOPAMAX in a tightly closed container.
- Keep TOPAMAX dry and away from moisture.

Keep TOPAMAX and all medicines out of the reach of children.

General information about the safe and effective use of TOPAMAX.

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

You can ask your pharmacist or healthcare provider for information about TOPAMAX that is written for health professionals.

What are the ingredients in TOPAMAX?
Active ingredient: topiramate
Inactive ingredients:

- **Tablets -** carnauba wax, hypromellose, lactose monohydrate, magnesium stearate, microcrystalline cellulose, polyethylene glycol, polysorbate 80, pregelatinized starch, purified water, sodium starch glycolate, synthetic iron oxide, and titanium dioxide.
- **Sprinkle Capsules -** black pharmaceutical ink, cellulose acetate, gelatin, povidone, sodium lauryl sulfate, sorbitan monolaurate, sugar spheres (sucrose and starch) and titanium dioxide.

Manufactured by: Janssen Ortho LLC, Guarabo, Puerto Rico 00778; Manufactured for: Janssen Pharmaceuticals, Inc., Titusville, NJ 08560

For more information, go to www.topamax.com or call 1-800-JANSSEN (1-800-526-7736).

This Medication Guide has been approved by the U.S. Food and Drug Administration Revised:10/2022