

**VIREAD®***(tenofovir disoproxil fumarate) Tablets*

RxOnly

**WARNING**

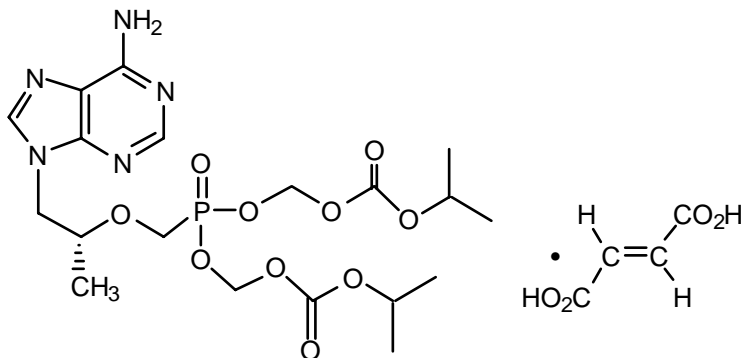
**LACTIC ACIDOSIS AND SEVERE HEPATOMEGALY WITH STEATOSIS, INCLUDING FATAL CASES, HAVE BEEN REPORTED WITH THE USE OF NUCLEOSIDE ANALOGS ALONE OR IN COMBINATION WITH OTHER ANTIRETROVIRALS (SEE WARNINGS).**

**VIREAD IS NOT INDICATED FOR THE TREATMENT OF CHRONIC HEPATITIS B VIRUS (HBV) INFECTION AND THE SAFETY AND EFFICACY OF VIREAD HAVE NOT BEEN ESTABLISHED IN PATIENTS CO-INFECTED WITH HBV AND HIV. SEVERE ACUTE EXACERBATIONS OF HEPATITIS B HAVE BEEN REPORTED IN PATIENTS WHO ARE CO-INFECTED WITH HBV AND HIV AND HAVE DISCONTINUED VIREAD. HEPATIC FUNCTION SHOULD BE MONITORED CLOSELY WITH BOTH CLINICAL AND LABORATORY FOLLOW-UP FOR AT LEAST SEVERAL MONTHS IN PATIENTS WHO DISCONTINUE VIREAD AND ARE CO-INFECTED WITH HIV AND HBV. IF APPROPRIATE, INITIATION OF ANTI-HEPATITIS B THERAPY MAY BE WARRANTED (SEE WARNINGS).**

**DESCRIPTION**

VIREAD® is the brand name for tenofovir disoproxil fumarate (a prodrug of tenofovir) which is a fumaric acid salt of *bis*-isopropoxycarbonyloxymethyl ester derivative of tenofovir. In vivo tenofovir disoproxil fumarate is converted to tenofovir, an acyclic nucleoside phosphonate (nucleotide) analog of adenosine 5'-monophosphate. Tenofovir exhibits activity against HIV-1 reverse transcriptase.

The chemical name of tenofovir disoproxil fumarate is 9-[(*R*)-2-[[bis[[isopropoxycarbonyl]oxy]methoxy]phosphinyl]methoxy]propyl]adenine fumarate (1:1). It has a molecular formula of  $C_{19}H_{30}N_5O_{10}P \cdot C_4H_4O_4$  and a molecular weight of 635.52. It has the following structural formula:



Tenofovir disoproxil fumarate is a white to off-white crystalline powder with a solubility of 13.4 mg/mL in distilled water at 25 °C. It has an octanol/phosphate buffer (pH 6.5) partition coefficient (log p) of 1.25 at 25 °C.

VIREAD tablets are for oral administration. Each tablet contains 300 mg of tenofovir disoproxil fumarate, which is equivalent to 245 mg of tenofovir disoproxil, and the following inactive ingredients: croscarmellose sodium, lactose monohydrate, magnesium stearate, microcrystalline cellulose, and pregelatinized starch. The tablets are coated with a light blue colored film (Opadry II Y-30-10671-A) that is made of FD&C blue #2 aluminum lake, hydroxypropyl methylcellulose 2910, lactose monohydrate, titanium dioxide, and triacetin.

In this insert, all dosages are expressed in terms of tenofovir disoproxil fumarate except where otherwise noted.

### **Microbiology**

***Mechanism of Action:*** Tenofovir disoproxil fumarate is an acyclic nucleoside phosphonate diester analog of adenosine monophosphate. Tenofovir disoproxil fumarate requires initial diester hydrolysis for conversion to tenofovir and subsequent phosphorylations by cellular enzymes to form tenofovir diphosphate. Tenofovir diphosphate inhibits the activity of HIV-1 reverse transcriptase by competing with the natural substrate deoxyadenosine 5'-triphosphate and, after incorporation into DNA, by DNA chain termination. Tenofovir diphosphate is a weak inhibitor of mammalian DNA polymerases  $\alpha$ ,  $\beta$ , and mitochondrial DNA polymerase  $\gamma$ .

***Antiviral Activity In Vitro:*** The in vitro antiviral activity of tenofovir against laboratory and clinical isolates of HIV-1 was assessed in lymphoblastoid cell lines, primary monocyte/macrophage cells and peripheral blood lymphocytes. The IC<sub>50</sub> (50% inhibitory concentration) values for tenofovir were in the range of 0.04  $\mu$ M to 8.5  $\mu$ M. In drug combination studies of tenofovir with nucleoside reverse transcriptase inhibitors (abacavir, didanosine, lamivudine, stavudine, zalcitabine, zidovudine), non-nucleoside reverse transcriptase inhibitors (delavirdine, efavirenz, nevirapine), and protease inhibitors (amprenavir, indinavir, nelfinavir, ritonavir, saquinavir), additive to synergistic effects were observed. Tenofovir displayed antiviral activity in vitro against HIV-1 clades A, B, C, D, E, F, G and O (IC<sub>50</sub> values ranged from 0.5  $\mu$ M to 2.2  $\mu$ M). The IC<sub>50</sub> values of tenofovir against HIV-2 ranged from 1.6  $\mu$ M to 4.9  $\mu$ M.

***Drug Resistance:*** HIV-1 isolates with reduced susceptibility to tenofovir have been selected in vitro. These viruses expressed a K65R mutation in reverse transcriptase and showed a 2-4 fold reduction in susceptibility to tenofovir.

Tenofovir-resistant isolates of HIV-1 have also been recovered from some patients treated with tenofovir in combination with certain antiretroviral agents. In treatment-naïve patients treated with Viread + lamivudine + efavirenz, viral isolates from 8/47 (17%) patients with virologic failure through week 144 showed reduced susceptibility to tenofovir. In treatment-experienced patients, 14/304 (5%) of the VIREAD-treated patients with virologic failure through week 96 showed reduced susceptibility to tenofovir. Genotypic analysis of the resistant isolates showed a mutation in the HIV-1 reverse transcriptase gene resulting in the K65R amino acid substitution.

***Cross-resistance:*** Cross-resistance among certain reverse transcriptase inhibitors has been recognized. The K65R mutation selected by tenofovir is also selected in some HIV-1 infected subjects treated with abacavir, didanosine, or zalcitabine. HIV isolates with this mutation also

show reduced susceptibility to emtricitabine and lamivudine. Therefore, cross-resistance among these drugs may occur in patients whose virus harbors the K65R mutation. HIV-1 isolates from patients (N=20) whose HIV-1 expressed a mean of 3 zidovudine-associated reverse transcriptase mutations (M41L, D67N, K70R, L210W, T215Y/F or K219Q/E/N), showed a 3.1-fold decrease in the susceptibility to tenofovir. Multinucleoside resistant HIV-1 with a T69S double insertion mutation in the reverse transcriptase showed reduced susceptibility to tenofovir.

### **Pharmacokinetics**

The pharmacokinetics of tenofovir disoproxil fumarate have been evaluated in healthy volunteers and HIV-1 infected individuals. Tenofovir pharmacokinetics are similar between these populations.

**Absorption:** VIREAD is a water soluble diester prodrug of the active ingredient tenofovir. The oral bioavailability of tenofovir from VIREAD in fasted patients is approximately 25%. Following oral administration of a single dose of VIREAD 300 mg to HIV-1 infected patients in the fasted state, maximum serum concentrations ( $C_{max}$ ) are achieved in  $1.0 \pm 0.4$  hrs.  $C_{max}$  and AUC values are  $296 \pm 90$  ng/mL and  $2287 \pm 685$  ng·hr/mL, respectively.

The pharmacokinetics of tenofovir are dose proportional over a VIREAD dose range of 75 to 600 mg and are not affected by repeated dosing.

**Effects of Food on Oral Absorption:** Administration of VIREAD following a high-fat meal (~700 to 1000 kcal containing 40 to 50% fat) increases the oral bioavailability, with an increase in tenofovir  $AUC_{0-\infty}$  of approximately 40% and an increase in  $C_{max}$  of approximately 14%. However, administration of VIREAD with a light meal did not have a significant effect on the pharmacokinetics of tenofovir when compared to fasted administration of the drug. Food delays the time to tenofovir  $C_{max}$  by approximately 1 hour.  $C_{max}$  and AUC of tenofovir are  $326 \pm 119$  ng/mL and  $3324 \pm 1370$  ng·hr/mL following multiple doses of VIREAD 300 mg once daily in the fed state, when meal content was not controlled.

**Distribution:** In vitro binding of tenofovir to human plasma or serum proteins is less than 0.7 and 7.2%, respectively, over the tenofovir concentration range 0.01 to 25 µg/mL. The volume of distribution at steady-state is  $1.3 \pm 0.6$  L/kg and  $1.2 \pm 0.4$  L/kg, following intravenous administration of tenofovir 1.0 mg/kg and 3.0 mg/kg.

**Metabolism and Elimination:** In vitro studies indicate that neither tenofovir disoproxil nor tenofovir are substrates of CYP450 enzymes.

Following IV administration of tenofovir, approximately 70-80% of the dose is recovered in the urine as unchanged tenofovir within 72 hours of dosing. Following single dose, oral administration of VIREAD, the terminal elimination half-life of tenofovir is approximately 17 hours. After multiple oral doses of VIREAD 300 mg once daily (under fed conditions),  $32 \pm 10\%$  of the administered dose is recovered in urine over 24 hours.

Tenofovir is eliminated by a combination of glomerular filtration and active tubular secretion. There may be competition for elimination with other compounds that are also renally eliminated.

### **Special Populations**

There were insufficient numbers from racial and ethnic groups other than Caucasian to adequately determine potential pharmacokinetic differences among these populations.

Tenofovir pharmacokinetics are similar in male and female patients.

Pharmacokinetic studies have not been performed in children (<18 years) or in the elderly (>65 years).

The pharmacokinetics of tenofovir following a 300 mg single dose of VIREAD have been studied in non-HIV infected patients with moderate to severe hepatic impairment. There were no substantial alterations in tenofovir pharmacokinetics in patients with hepatic impairment compared with unimpaired patients. No change in VIREAD dosing is required in patients with hepatic impairment.

The pharmacokinetics of tenofovir are altered in patients with renal impairment (See WARNINGS, Renal Impairment). In patients with creatinine clearance <50 mL/min or with end-stage renal disease (ESRD) requiring dialysis,  $C_{max}$ , and  $AUC_{0-\infty}$  of tenofovir were increased (Table 1). It is recommended that the dosing interval for VIREAD be modified in patients with creatinine clearance <50 mL/min or in patients with ESRD who require dialysis (see DOSAGE AND ADMINISTRATION).

**Table 1. Pharmacokinetic Parameters (Mean±SD) of Tenofovir\* in Patients with varying Degrees of Renal Function**

<b>Baseline Creatinine Clearance (mL/min)</b>	<b>&gt;80 (N=3)</b>	<b>50-80 (N=10)</b>	<b>30-49 (N=8)</b>	<b>12-29 (N=11)</b>
$C_{max}$ (ng/mL)	335.4 ± 31.8	330.4 ± 61.0	372.1 ± 156.1	601.6 ± 185.3
$AUC_{0-\infty}$ (ng·hr/mL)	2184.5 ± 257.4	3063.8 ± 927.0	6008.5 ± 2504.7	15984.7 ± 7223.0
CL/F (mL/min)	1043.7 ± 115.4	807.7 ± 279.2	444.4 ± 209.8	177.0 ± 97.1
$CL_{renal}$ (mL/min)	243.5 ± 33.3	168.6 ± 27.5	100.6 ± 27.5	43.0 ± 31.2

\*300 mg, single dose of VIREAD

Tenofovir is efficiently removed by hemodialysis with an extraction coefficient of approximately 54%. Following a single 300 mg dose of VIREAD, a four-hour hemodialysis session removed approximately 10% of the administered tenofovir dose.

### ***Drug Interactions***

At concentrations substantially higher (~300-fold) than those observed in vivo, tenofovir did not inhibit in vitro drug metabolism mediated by any of the following human CYP450 isoforms: CYP3A4, CYP2D6, CYP2C9 or CYP2E1. However, a small (6%) but statistically significant reduction in metabolism of CYP1A substrate was observed. Based on the results of in vitro experiments and the known elimination pathway of tenofovir, the potential for CYP450 mediated interactions involving tenofovir with other medicinal products is low (See Pharmacokinetics).

Tenofovir is primarily excreted by the kidneys by a combination of glomerular filtration and active tubular secretion. Co-administration of VIREAD with drugs that are eliminated by active tubular secretion may increase serum concentrations of either tenofovir or the co-administered drug, due to competition for this elimination pathway. Drugs that decrease renal function may also increase serum concentrations of tenofovir.

VIREAD has been evaluated in healthy volunteers in combination with abacavir, adefovir dipivoxil, atazanavir, didanosine, efavirenz, emtricitabine, indinavir, lamivudine, lopinavir/ritonavir, methadone, oral contraceptives and ribavirin. Tables 2 and 3 summarize pharmacokinetic effects of co-administered drug on tenofovir pharmacokinetics and effects of VIREAD on the pharmacokinetics of co-administered drug.

Table 4 summarizes the drug interaction between VIREAD and didanosine. When administered with multiple doses of VIREAD, the  $C_{max}$  and AUC of didanosine 400 mg increased significantly. The mechanism of this interaction is unknown. When didanosine 250 mg enteric-coated capsules were administered with VIREAD, systemic exposures to didanosine were similar to those seen with the 400 mg enteric-coated capsules alone under fasted conditions.

**Table 2. Drug Interactions: Changes in Pharmacokinetic Parameters for Tenofovir<sup>1</sup> in the Presence of the Co-administered Drug**

Co-administered Drug	Dose of Co-administered Drug (mg)	N	% Change of Tenofovir Pharmacokinetic Parameters <sup>2</sup> (90% CI)		
			$C_{max}$	AUC	$C_{min}$
Abacavir	300 once	8	↔	↔	NC
Adefovir dipivoxil	10 once	22	↔	↔	NC
Atazanavir <sup>3</sup>	400 once daily x 14 days	33	↑ 14 (↑ 8 to ↑ 20)	↑ 24 (↑ 21 to ↑ 28)	↑ 22 (↑ 15 to ↑ 30)
Didanosine (enteric-coated)	400 once	25	↔	↔	↔
Didanosine (buffered)	250 or 400 once daily x 7 days	14	↔	↔	↔
Efavirenz	600 once daily x 14 days	29	↔	↔	↔
Emtricitabine	200 once daily x 7 days	17	↔	↔	↔
Indinavir	800 three times daily x 7 days	13	↑ 14 (↓ 3 to ↑ 33)	↔	↔
Lamivudine	150 twice daily x 7 days	15	↔	↔	↔
Lopinavir/Ritonavir	400/100 twice daily x 14 days	24	↔	↑ 32 (↑ 25 to ↑ 38)	↑ 51 (↑ 37 to ↑ 66)

1. Patients received VIREAD 300 mg once daily.

2. Increase = ↑; Decrease = ↓; No Effect = ⇔; NC = Not Calculated  
 3. REYATAZ<sup>®</sup> Prescribing Information (Bristol-Myers Squibb)

Following multiple dosing to HIV-negative subjects receiving either chronic methadone maintenance therapy or oral contraceptives, or single doses of ribavirin, steady state tenofovir pharmacokinetics were similar to those observed in previous studies, indicating lack of clinically significant drug interactions between these agents and VIREAD.

**Table 3. Drug Interactions: Changes in Pharmacokinetic Parameters for Co-administered Drug in the Presence of VIREAD**

Co-administered Drug	Dose of Co-administered Drug (mg)	N	% CHANGE OF CO-ADMINISTERED DRUG PHARMACOKINETIC PARAMETERS <sup>1</sup> (90% CI)		
			C <sub>max</sub>	AUC	C <sub>min</sub>
Abacavir	300 once	8	↑ 12 (↓ 1 to ↑ 26)	⇔	NA
Adefovir dipivoxil	10 once	22	⇔	⇔	NA
Efavirenz	600 once daily x 14 days	30	⇔	⇔	⇔
Emtricitabine	200 once daily x 7 days	17	⇔	⇔	↑ 20 (↑ 12 to ↑ 29)
Indinavir	800 three times daily x 7 days	12	↓ 11 (↓ 30 to ↑ 12)	⇔	⇔
Lamivudine	150 twice daily x 7 days	15	↓ 24 (↓ 34 to ↓ 12)	⇔	⇔
Lopinavir	Lopinavir/Ritonavir 400/100 twice daily x 14 days	24	⇔	⇔	⇔
Methadone <sup>2</sup>	40-110 once daily x 14 days <sup>3</sup>	13	⇔	⇔	⇔
Oral Contraceptives <sup>4</sup>	Ethinyl Estradiol/Norgestimate (Ortho-Tricyclen <sup>®</sup> ) Once daily x 7 days	20	⇔	⇔	⇔
Ribavirin	600 once	22	⇔	⇔	NA

Ritonavir	Lopinavir/Ritona vir 400/100 twice daily x 14 days	24	↔	↔	↔
Atazanavir <sup>5</sup>	400 once daily x 14 days	34	↓ 21 (↓ 27 to ↓ 14)	↓ 25 (↓ 30 to ↓ 19)	↓ 40 (↓ 48 to ↓ 32)
Atazanavir <sup>5</sup>	Atazanavir/Riton avir 300/100 once daily x 42 days	10	↓ 28 (↓ 50 to ↑ 5)	↓ 25 <sup>6</sup> (↓ 42 to ↓ 3)	↓ 23 <sup>6</sup> (↓ 46 to ↑ 10)

1. Increase = ↑; Decrease = ↓; No Effect = ↔; NA = Not Applicable
2. R-(active), S-and total methadone exposures were equivalent when dosed alone or with VIREAD.
3. Individual subjects were maintained on their stable methadone dose. No pharmacodynamic alterations (opiate toxicity or withdrawal signs or symptoms) were reported.
4. Ethinyl estradiol and 17-deacetyl norgestimate (pharmacologically active metabolite) exposures were equivalent when dosed alone or with VIREAD.
5. REYATAZ Prescribing Information (Bristol-Myers Squibb)
6. In HIV-infected patients, addition of tenofovir DF to atazanavir 300 mg plus ritonavir 100 mg, resulted in AUC and C<sub>min</sub> values of atazanavir that were 2.3- and 4-fold higher than the respective values observed for atazanavir 400 mg when given alone.

**Table 4. Drug Interactions: Pharmacokinetic Parameters for Didanosine in the Presence of VIREAD**

Didanosine <sup>1</sup> Dose (mg)/ Method of Administratio n <sup>2</sup>	VIREAD Method of Administration <sup>2</sup>	N	% Difference (90% CI) vs. Didanosine 400 mg alone, Fasted <sup>3</sup>	
			C <sub>max</sub>	AUC
<b>Buffered tablets</b>				
400 once daily <sup>4</sup> x 7 days	Fasted 1 hour after didanosine	14	↑ 28 (↑ 11 to ↑ 48)	↑ 44 (↑ 31 to ↑ 59)
<b>Enteric coated capsules</b>				
400 once, fasted	With food, 2 hr after didanosine	26	↑ 48 (↑ 25 to ↑ 76)	↑ 48 (↑ 31 to ↑ 67)
400 once, with food	Simultaneously with didanosine	26	↑ 64 (↑ 41 to ↑ 89)	↑ 60 (↑ 44 to ↑ 79)
250 once, fasted	With food, 2 hr after didanosine	28	↓ 10 (↓ 22 to ↑ 3)	↔
250 once, fasted	Simultaneously with didanosine	28	↔	↑ 14 (0 to ↑ 31)

250 once, with food	Simultaneously with didanosine	28	↓ 29 (↓ 39 to ↓ 18)	↓ 11 (↓ 23 to ↑ 2)
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1. See PRECAUTIONS regarding use of didanosine with VIREAD.
2. Administration with food was with a light meal (~373 kcal, 20% fat).
3. Increase = ↑; Decrease = ↓; No Difference = ⇔
4. Includes 4 subjects weighing <60 kg receiving ddl 250 mg.

## INDICATIONS AND USAGE

VIREAD is indicated in combination with other antiretroviral agents for the treatment of HIV-1 infection. This indication is based on analyses of plasma HIV-1 RNA levels and CD4 cell counts in controlled studies of VIREAD in treatment-naïve adults and in treatment-experienced adults.

Additional important information regarding the use of VIREAD for the treatment of HIV-1 infection:

- There are no study results demonstrating the effect of VIREAD on clinical progression of HIV-1.
- The use of VIREAD should be considered for treating adult patients with HIV-1 strains that are expected to be susceptible to tenofovir as assessed by laboratory testing or treatment history (See Description of Clinical Studies).

## Description of Clinical Studies

### *Treatment-Naïve Patients*

#### **Study 903: VIREAD + Lamivudine +Efavirenz Compared to Stavudine + Lamivudine + Efavirenz**

Data through 144 weeks are reported for Study 903, a double-blind, active-controlled multicenter study comparing VIREAD (300 mg QD) administered in combination with lamivudine and efavirenz versus stavudine, lamivudine, and efavirenz in 600 antiretroviral-naïve patients. Patients had a mean age of 36 years (range 18–64), 74% were male, 64% were Caucasian and 20% were Black. The mean baseline CD4 cell count was 279 cells/mm<sup>3</sup> (range 3–956) and median baseline plasma HIV-1 RNA was 77,600 copies/mL (range 417–5,130,000). Patients were stratified by baseline HIV-1 RNA and CD4 count. Forty-three percent of patients had baseline viral loads >100,000 copies/mL and 39% had CD4 cell counts <200 cells/mm<sup>3</sup>. Treatment outcomes through 144 weeks are presented in Table 5.

**Table 5. Outcomes of Randomized Treatment (Study 903)**



Outcomes	At Week 48		At Week 144	
	VIREAD+3TC +EFV (N=299)	Stavudine+ 3TC+EFV (N=301)	VIREAD+3TC +EFV (N=299)	Stavudine+ 3TC+EFV (N=301)
	%	%	%	%
Responder <sup>1</sup>	79%	82%	68%	62%
Virologic failure <sup>2</sup>	6%	4%	10%	8%
Rebound	5%	3%	8%	7%
Never suppressed	0%	1%	0%	0%
Added an antiretroviral agent	1%	1%	2%	1%
Death	<1%	1%	<1%	2%
Discontinued due to adverse event	6%	6%	8%	13%
Discontinued for other reasons <sup>3</sup>	8%	7%	14%	15%

1. Patients achieved and maintained confirmed HIV-1 RNA <400 copies/mL through Week 48 and 144.

2. Includes confirmed viral rebound and failure to achieve confirmed <400 copies/mL through Week 48 and 144.

3. Includes lost to follow-up, patient's withdrawal, noncompliance, protocol violation and other reasons.

Achievement of plasma HIV-1 RNA concentrations of less than 400 copies/mL at week 144 was similar between the two treatment groups for the population stratified at baseline on the basis of HIV-1 RNA concentration (> or  $\geq$  100,000 copies/mL) and CD4 cell count (< or  $\geq$  200 cells/mm<sup>3</sup>). Through 144 weeks of therapy, 62% and 58% of patients in the VIREAD and stavudine arms, respectively achieved and maintained confirmed HIV-1 RNA <50 copies/mL. The mean increase from baseline in CD4 cell count was 263 cells/mm<sup>3</sup> for the VIREAD arm and 283 cells/mm<sup>3</sup> for the stavudine arm.

Through 144 weeks, eleven patients in the VIREAD group and nine patients in the stavudine group experienced a new CDC Class C event.

### Resistance Analyses of VIREAD in Treatment Naïve Patients

Genotypic analyses of patients with virologic failure showed development of efavirenz-associated and lamivudine-associated mutations to occur most frequently and with no difference between the treatment arms. The K65R mutation occurred in 8 patients on the VIREAD arm and in 2 patients on the Stavudine arm. Of the 8 patients who developed K65R in the VIREAD arm through 144 weeks, 7 of these occurred in the first 48 weeks of treatment and one at week 96. Other mutations resulting in resistance to VIREAD were not identified in this study.

#### *Treatment-Experienced Patients*

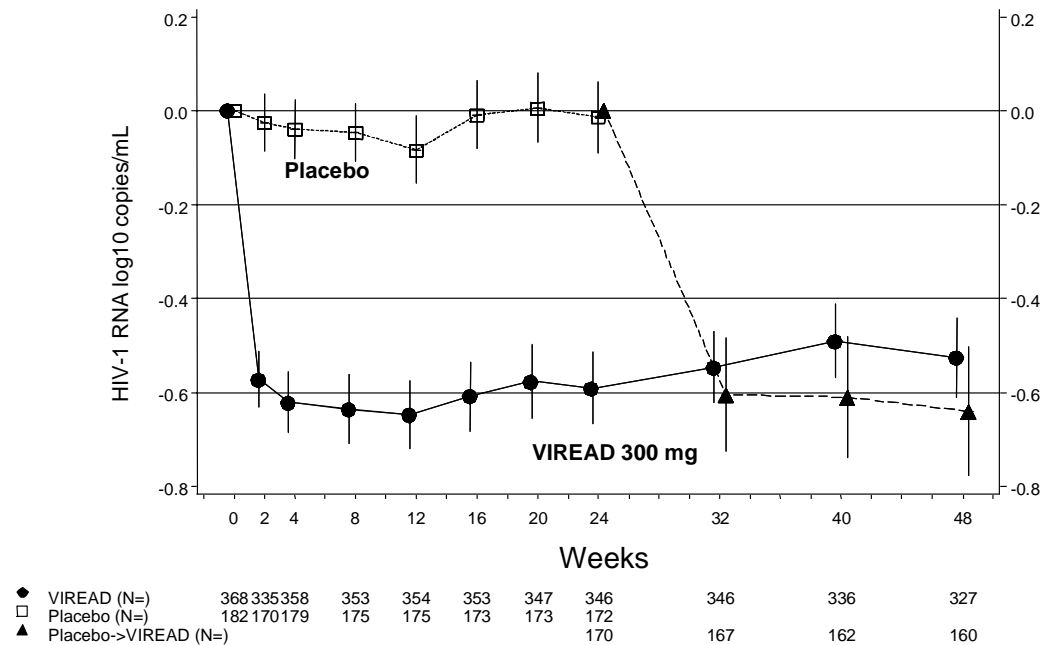
#### **Study 907: VIREAD + Standard Background Therapy (SBT) Compared to Placebo + SBT**

Study 907 was a 24 week, double-blind placebo-controlled multicenter study of VIREAD added to a stable background regimen of antiretroviral agents in 550 treatment-experienced

patients. After 24 weeks of blinded study treatment, all patients continuing on study were offered open-label VIREAD for an additional 24 weeks. Patients had a mean baseline CD4 cell count of 427 cells/mm<sup>3</sup> (range 23–1385), median baseline plasma HIV-1 RNA of 2340 (range 50–75,000) copies/mL, and mean duration of prior HIV-1 treatment was 5.4 years. Mean age of the patients was 42 years, 85% were male and 69% were Caucasian, 17% Black and 12% Hispanic.

Changes from baseline in log<sub>10</sub> copies/mL plasma HIV-1 RNA levels over time up to week 48 are presented below in Figure 1.

**Figure 1**  
**Mean Change from Baseline in Plasma HIV-1 RNA (log<sub>10</sub> copies/mL) Through Week 48:**  
**Study 907 (All Available Data)<sup>†</sup>**



◆ VIREAD (N=)	368	335	358	353	354	353	347	346	346	336	327
□ Placebo (N=)	182	170	179	175	175	173	173	172	170	167	160
▲ Placebo->VIREAD (N=)											

<sup>†</sup> Patients on placebo after 24 weeks received VIREAD.

The percent of patients with HIV-1 RNA <400 copies/mL and outcomes of patients through 48 weeks are summarized in Table 6.

**TABLE 6. OUTCOMES OF RANDOMIZED TREATMENT (STUDY 907)**

Outcomes	0-24 weeks		0-48 weeks	24-48 weeks
	VIREAD (N=368) %	Placebo (N=182) %	VIREAD (N=368) %	Placebo Crossover to VIREAD (N=170) %
HIV-1 RNA <400 copies/mL <sup>1</sup>	40%	11%	28%	30%
Virologic failure <sup>2</sup>	53%	84%	61%	64%
Discontinued due to adverse event	3%	3%	5%	5%

Discontinued for other reasons <sup>3</sup>	3%	3%	5%	1%
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1. Patients with HIV-1 RNA <400 copies/mL and no prior study drug discontinuation at Week 24 and 48 respectively.
2. Patients with HIV-1 RNA ≥400 copies/mL efficacy failure or missing HIV –1 RNA at Week 24 and 48 respectively.
3. Includes lost to follow up, patient withdrawal, noncompliance, protocol violation and other reasons.

At 24 weeks of therapy, there was a higher proportion of patients in the VIREAD arm compared to the placebo arm with HIV-1 RNA <50 copies/mL (19% and 1%, respectively). Mean change in absolute CD4 counts by week 24 was +11 cells/mm<sup>3</sup> for the VIREAD group and -5 cells/mm<sup>3</sup> for the placebo group. Mean change in absolute CD4 counts by week 48 was +4 cells/mm<sup>3</sup> for the VIREAD group.

Through week 24, one patient in the VIREAD group and no patients in the placebo arm experienced a new CDC Class C event.

### Genotypic Analyses of VIREAD in Patients with Previous Antiretroviral Therapy

The virologic response to VIREAD therapy has been evaluated with respect to baseline viral genotype (N=222) in treatment experienced patients participating in two controlled trials.

In two clinical studies, 94% of the participants evaluated had baseline HIV-1 isolates expressing at least one NRTI mutation. These included resistance mutations associated with zidovudine (M41L, D67N, K70R, L210W, T215Y/F or K219Q/E/N), the abacavir/emtricitabine/lamivudine-associated mutation (M184V), and others. In addition the majority of participants evaluated had mutations associated with either PI or NNRTI use. Virologic responses for patients in the genotype substudy were similar to the overall study results.

Several exploratory analyses were conducted to evaluate the effect of specific mutations and mutational patterns on virologic outcome. Descriptions of numerical differences in HIV-1 RNA response are displayed in Table 7. Because of the large number of potential comparisons, statistical testing was not conducted.

Varying degrees of cross-resistance of VIREAD to pre-existing zidovudine-associated mutations were observed and appeared to depend on the number of specific mutations. VIREAD-treated patients whose HIV-1 expressed 3 or more zidovudine-associated mutations that included either the M41L or L210W reverse transcriptase mutation showed reduced responses to VIREAD therapy; however, these responses were still improved compared with placebo. The presence of the D67N, K70R, T215Y/F or K219Q/E/N mutation did not appear to affect responses to VIREAD therapy. The HIV-1 RNA responses by number and type of baseline zidovudine-associated mutations are shown in Table 7.

Table 7. HIV-1 RNA Response at Week 24 by Number of Baseline Zidovudine-Associated Mutations (Intent-To-Treat)<sup>1</sup>

Number of baseline zidovudine-associated mutations <sup>2</sup>	Change in HIV-1 RNA <sup>3</sup> (N)	
	VIREAD 300 mg	Placebo
None	-0.80 (68)	-0.11 (29)
Any	-0.50 (154)	0 (81)
1–2	-0.66 (55)	-0.04 (33)

≥3 including M41L or L210W	-0.21 (57)	+0.01 (29)
≥3 without M41L or L210W	-0.67 (42)	+0.07 (19)

1. Genotypic testing performed by Virco Laboratories and Visible Genetics TruGene™ technology.
2. M41L, D67N, K70R, L210W, T215Y/F or K219Q/E/N in RT.
3. Average HIV-1 RNA change from baseline through week 24 (DAVG<sub>24</sub>) in log<sub>10</sub> copies/mL.

In the protocol defined analyses, virologic response to VIREAD was not reduced in patients with HIV-1 that expressed the abacavir/emtricitabine/lamivudine-associated M184V mutation. In the absence of zidovudine-associated mutations, patients with the M184V mutation receiving VIREAD showed a -0.84 log<sub>10</sub> copies/mL decrease in their HIV-1 RNA relative to placebo. In the presence of zidovudine-associated mutations, the M184V mutation did not affect the mean HIV-1 RNA responses to VIREAD treatment. HIV-1 RNA responses among these patients were durable through week 48.

### Phenotypic Analyses of VIREAD in Patients with Previous Antiretroviral Therapy

The virologic response to VIREAD therapy has been evaluated with respect to baseline phenotype (N=100) in treatment-experienced patients participating in two controlled trials. Phenotypic analysis of baseline HIV-1 from patients in these studies demonstrated a correlation between baseline susceptibility to VIREAD and response to VIREAD therapy. Table 8 summarizes the HIV-1 RNA response by baseline VIREAD susceptibility.

Table 8. HIV-1 RNA Response at Week 24 by Baseline VIREAD Susceptibility (Intent-To-Treat)<sup>1</sup>

Baseline VIREAD Susceptibility <sup>2</sup>	Change in HIV-1 RNA <sup>3</sup> (N)
≤1	<b>-0.74 (35)</b>
>1 and ≤3	<b>-0.56 (49)</b>
>3 and ≤4	<b>-0.3 (7)</b>
≤4	<b>-0.61 (91)</b>
>4	<b>-0.12 (9)</b>

1. Tenofvir susceptibility was determined by recombinant phenotypic Antivirogram™ assay (Virco).
2. Fold change in susceptibility from wild-type.
3. Average HIV-1 RNA change from baseline through week 24 (DAVG<sub>24</sub>) in log<sub>10</sub> copies/mL.

### CONTRAINDICATIONS

VIREAD is contraindicated in patients with previously demonstrated hypersensitivity to any of the components of the product.

### WARNINGS

#### Lactic Acidosis/Severe Hepatomegaly with Steatosis

Lactic acidosis and severe hepatomegaly with steatosis, including fatal cases, have been reported with the use of nucleoside analogs alone or in combination with other antiretrovirals. A majority of these cases have been in women. Obesity and prolonged nucleoside exposure may be risk factors. Particular caution should be exercised when administering nucleoside analogs to any patient with known risk factors for liver disease; however, cases have also been reported in patients with no known risk factors. Treatment with VIREAD should be suspended in any patient who develops clinical or laboratory

findings suggestive of lactic acidosis or pronounced hepatotoxicity (which may include hepatomegaly and steatosis even in the absence of marked transaminase elevations).

### **Patients Co-infected with HIV and Hepatitis B Virus**

It is recommended that all patients with HIV be tested for the presence of chronic hepatitis B virus (HBV) before initiating antiretroviral therapy. VIREAD is not indicated for the treatment of chronic HBV infection and the safety and efficacy of VIREAD have not been established in patients co-infected with HBV and HIV. Severe acute exacerbations of hepatitis B have been reported in patients who are co-infected with HBV and HIV and have discontinued VIREAD. Hepatic function should be monitored closely with both clinical and laboratory follow-up for at least several months in patients who discontinue VIREAD and are co-infected with HIV and HBV. If appropriate, initiation of anti-hepatitis B therapy may be warranted.

### **Renal Impairment**

Tenofovir is principally eliminated by the kidney. Dosing interval adjustment is recommended in all patients with creatinine clearance <50 mL/min (see DOSAGE AND ADMINISTRATION). No safety data are available in patients with renal dysfunction who received VIREAD using these dosing guidelines.

Renal impairment, including cases of acute renal failure and Fanconi syndrome (renal tubular injury with severe hypophosphatemia), has been reported in association with the use of VIREAD (see Adverse Reactions- Post Marketing Experience). The majority of these cases occurred in patients with underlying systemic or renal disease, or in patients taking nephrotoxic agents, however, some cases occurred in patients without identified risk factors.

VIREAD should be avoided with concurrent or recent use of a nephrotoxic agent. Patients at risk for, or with a history of, renal dysfunction and patients receiving concomitant nephrotoxic agents should be carefully monitored for changes in serum creatinine and phosphorus.

## **PRECAUTIONS**

### **Drug Interactions**

When administered with VIREAD,  $C_{max}$  and AUC of didanosine administered as either the buffered or enteric-coated formulation increased significantly (see Table 4). The mechanism of this interaction is unknown. Higher didanosine concentrations could potentiate didanosine-associated adverse events, including pancreatitis and neuropathy. In adults weighing >60kg, the didanosine dose should be reduced to 250 mg when it is co-administered with VIREAD. Data are not available to recommend a dose adjustment of didanosine for patients weighing <60 kg. When co-administered, VIREAD and didanosine EC may be taken under fasted conditions or with a light meal (<400 kcal, 20% fat). Co-administration of didanosine buffered tablet formulation with VIREAD should be under fasted conditions. **Co-administration of VIREAD and didanosine should be undertaken with caution and patients receiving this combination should be monitored closely for didanosine-associated adverse events. Didanosine should be discontinued in patients who develop didanosine-associated adverse events.**

Since tenofovir is primarily eliminated by the kidneys, co-administration of VIREAD with drugs that reduce renal function or compete for active tubular secretion may increase serum concentrations of tenofovir and/or increase the concentrations of other renally eliminated drugs. Some examples include, but are not limited to adefovir dipivoxil, cidofovir, acyclovir, valacyclovir, ganciclovir and valganciclovir.

Higher tenofovir concentrations could potentiate VIREAD-associated adverse events, including renal disorders.

Atazanavir and lopinavir/ritonavir have been shown to increase tenofovir concentrations. The mechanism of this interaction is unknown. Patients receiving atazanavir and lopinavir/ritonavir and VIREAD should be monitored for VIREAD-associated adverse events. VIREAD should be discontinued in patients who develop VIREAD-associated adverse events.

**VIREAD decreases the AUC and C<sub>min</sub> of atazanavir. When coadministered with VIREAD, it is recommended that atazanavir 300 mg is given with ritonavir 100 mg. Atazanavir without ritonavir should not be coadministered with VIREAD.**

### **Bone Effects**

In study 903 through 144 weeks, decreases from baseline in bone mineral density (BMD) were seen at the lumbar spine and hip in both arms of the study. At week 144, there was a significantly greater mean percentage decrease from baseline in BMD at the lumbar spine in patients receiving VIREAD + lamivudine + efavirenz ( $-2.2\% \pm 3.9$ ) compared with patients receiving stavudine + lamivudine + efavirenz ( $-1.0\% \pm 4.6$ ). Changes in BMD at the hip were similar between the two treatment groups ( $-2.8\% \pm 3.5$  in the VIREAD group vs.  $-2.4\% \pm 4.5$  in the stavudine group). In both groups, the majority of the reduction in BMD occurred in the first 24-48 weeks of the study and this reduction was sustained through week 144. Twenty-eight percent of VIREAD-treated patients vs. 21% of the stavudine-treated patients lost at least 5% of BMD at the spine or 7% of BMD at the hip. Clinically relevant fractures (excluding fingers and toes) were reported in 4 patients in the VIREAD group and 6 patients in the stavudine group. In addition, there were significant increases in biochemical markers of bone metabolism (serum bone-specific alkaline phosphatase, serum osteocalcin, serum C-telopeptide and urinary N-telopeptide) in the VIREAD group relative to the stavudine group, suggesting increased bone turnover. Serum parathyroid hormone levels and 1,25 Vitamin D levels were also higher in the VIREAD group. Except for bone specific alkaline phosphatase, these changes resulted in values that remained within the normal range. The effects of VIREAD-associated changes in BMD and biochemical markers on long-term bone health and future fracture risk are unknown.

Bone monitoring should be considered for HIV infected patients who have a history of pathologic bone fracture or are at risk for osteopenia. Although the effect of supplementation with calcium and vitamin D was not studied, such supplementation may be beneficial for all patients. If bone abnormalities are suspected then appropriate consultation should be obtained.

### **Fat Redistribution**

Redistribution/accumulation of body fat including central obesity, dorsocervical fat enlargement (buffalo hump), peripheral wasting, facial wasting, breast enlargement, and "cushingoid appearance" have been observed in patients receiving antiretroviral therapy. The mechanism and long-term consequences of these events are currently unknown. A causal relationship has not been established.

### **Immune Reconstitution Syndrome**

Immune reconstitution syndrome has been reported in patients treated with combination

antiretroviral therapy, including VIREAD. During the initial phase of combination antiretroviral treatment, patients whose immune system responds may develop an inflammatory response to indolent or residual opportunistic infections (such as *Mycobacterium avium* infection, cytomegalovirus, *Pneumocystis jirovecii* pneumonia (PCP), or tuberculosis), which may necessitate further evaluation and treatment.

### **Animal Toxicology**

Tenofovir and tenofovir disoproxil fumarate administered in toxicology studies to rats, dogs and monkeys at exposures (based on AUCs) greater than or equal to 6 fold those observed in humans caused bone toxicity. In monkeys the bone toxicity was diagnosed as osteomalacia. Osteomalacia observed in monkeys appeared to be reversible upon dose reduction or discontinuation of tenofovir. In rats and dogs, the bone toxicity manifested as reduced bone mineral density. The mechanism(s) underlying bone toxicity is unknown.

Evidence of renal toxicity was noted in 4 animal species. Increases in serum creatinine, BUN, glycosuria, proteinuria, phosphaturia and/or calciuria and decreases in serum phosphate were observed to varying degrees in these animals. These toxicities were noted at exposures (based on AUCs) 2–20 times higher than those observed in humans. The relationship of the renal abnormalities, particularly the phosphaturia, to the bone toxicity is not known.

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

Long-term oral carcinogenicity studies of tenofovir disoproxil fumarate in mice and rats were carried out at exposures up to approximately 16 times (mice) and 5 times (rats) those observed in humans at the therapeutic dose for HIV infection. At the high dose in female mice, liver adenomas were increased at exposures 16 times that in humans. In rats, the study was negative for carcinogenic findings at exposures up to 5 times that observed in humans at the therapeutic dose.

Tenofovir disoproxil fumarate was mutagenic in the in vitro mouse lymphoma assay and negative in an in vitro bacterial mutagenicity test (Ames test). In an in vivo mouse micronucleus assay, tenofovir disoproxil fumarate was negative when administered to male mice.

There were no effects on fertility, mating performance or early embryonic development when tenofovir disoproxil fumarate was administered to male rats at a dose equivalent to 10 times the human dose based on body surface area comparisons for 28 days prior to mating and to female rats for 15 days prior to mating through day seven of gestation. There was, however, an alteration of the estrous cycle in female rats.

### **Pregnancy**

#### **Pregnancy category B:**

Reproduction studies have been performed in rats and rabbits at doses up to 14 and 19 times the human dose based on body surface area comparisons and revealed no evidence of impaired fertility or harm to the fetus due to tenofovir. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of human response, VIREAD should be used during pregnancy only if clearly needed.

Antiretroviral Pregnancy Registry: To monitor fetal outcomes of pregnant women exposed to VIREAD, an Antiretroviral Pregnancy Registry has been established. Healthcare providers are encouraged to register patients by calling 1-800-258-4263.

***Nursing Mothers:*** *The Centers for Disease Control and Prevention recommend that HIV-infected mothers not breast-feed their infants to avoid risking postnatal transmission of HIV.* Studies in rats have demonstrated that tenofovir is secreted in milk. It is not known whether tenofovir is excreted in human milk. Because of both the potential for HIV transmission and the potential for serious adverse reactions in nursing infants, ***mothers should be instructed not to breast-feed if they are receiving VIREAD.***

### **Pediatric Use**

Safety and effectiveness in pediatric patients have not been established.

### **Geriatric Use**

Clinical studies of VIREAD did not include sufficient numbers of subjects aged 65 and over to determine whether they respond differently from younger subjects. In general, dose selection for the elderly patient should be cautious, keeping in mind the greater frequency of decreased hepatic, renal, or cardiac function, and of concomitant disease or other drug therapy.

## **ADVERSE REACTIONS**

**Clinical Trials:** More than 12,000 patients have been treated with VIREAD alone or in combination with other antiretroviral medicinal products for periods of 28 days to 215 weeks in Phase I-III clinical trials and expanded access studies. A total of 1,287 patients have received VIREAD 300 mg once daily in Phase I-III clinical trials; over 11,000 patients have received VIREAD in expanded access studies.

### ***Treatment-Naïve Patients***

**Treatment-Emergent Adverse Events:** The most common adverse reactions seen in a double-blind comparative controlled study in which 600 treatment-naïve patients received VIREAD (N=299) or stavudine (N=301) in combination with lamivudine and efavirenz for 144 weeks (Study 903) were mild to moderate gastrointestinal events and dizziness.

Mild adverse events (Grade 1) were common with a similar incidence in both arms, and included dizziness, diarrhea and nausea. Selected treatment-emergent moderate to severe adverse events are summarized in Table 9.



**Table 9. Selected Treatment-Emergent Adverse Events (Grades 2–4) Reported in ≥5% in Any Treatment Group in Study 903 (0–144 weeks)**

	VIREAD+3TC+EFV	d4T+3TC+EFV
	N=299	N=301
Body as a Whole		
Headache	14%	17%
Pain	13%	12%
Fever	8%	7%
Abdominal Pain	7%	12%
Back Pain	9%	8%
Asthenia	6%	7%
Digestive System		
Diarrhea	11%	13%
Nausea	8%	9%
Dyspepsia	4%	5%
Vomiting	5%	9%
Metabolic Disorders		
Lipodystrophy <sup>1</sup>	1%	8%
Musculoskeletal		
Arthralgia	5%	7%
Myalgia	3%	5%
Nervous System		
Depression	11%	10%
Insomnia	5%	8%
Dizziness	3%	6%
Peripheral neuropathy <sup>2</sup>	1%	5%
Anxiety	6%	6%
Respiratory		
Pneumonia	5%	5%
Skin and Appendages		
Rash Event <sup>3</sup>	18%	12%

1. Lipodystrophy represents a variety of investigator-described adverse events not a protocol-defined syndrome
2. Peripheral neuropathy includes peripheral neuritis and neuropathy
3. Rash event includes rash, pruritus, maculopapular rash, urticaria, vesiculobullous rash, and pustular rash

**Laboratory Abnormalities:** With the exception of cholesterol and triglyceride elevations that were more common in the stavudine group (15% and 14%) compared with VIREAD (5% and 3%) respectively, laboratory abnormalities observed in this study occurred with similar frequency in the VIREAD and stavudine treatment arms. A summary of Grade 3 and 4 laboratory abnormalities is provided in Table 10.

**Table 10. Grade 3/4 Laboratory Abnormalities Reported in ≥ 1% of VIREAD-Treated Patients in Study 903 (0–144 weeks)**

	<b>VIREAD+3TC+EFV</b>	<b>d4T+3TC+EFV</b>
	<b>N=299</b>	<b>N=301</b>
Any $\geq$ Grade 3 Laboratory Abnormality	36%	42%
Total Cholesterol (> 300 mg/dL)	5%	15%
Creatine Kinase (M: >990 U/L) (F: >845 U/L)	12%	12%
Serum Amylase (>175 U/L)	9%	8%
AST (M: >180 U/L) (F: >170 U/L)	5%	7%
ALT (M: >215 U/L) (F: >170 U/L)	4%	5%
Hematuria (>100 RBC/HPF)	7%	7%
Neutrophil (<750/mm <sup>3</sup> )	3%	1%
Triglyceride (>750 mg/dL)	3%	14%

### ***Treatment-Experienced Patients***

**Treatment-Emergent Adverse Events:** The adverse reactions seen in treatment experienced patients were generally consistent with those seen in treatment naïve patients including mild to moderate gastrointestinal events, such as nausea, diarrhea, vomiting and flatulence. Less than 1% of patients discontinued participation in the clinical studies due to gastrointestinal adverse events (Study 907).

A summary of moderate to severe, treatment-emergent adverse events that occurred during the first 48 weeks of Study 907 is provided in Table 11.

**Table 11. Selected Treatment-Emergent Adverse Events (Grades 2–4) Reported in ≥3% in Any Treatment Group in Study 907 (0–48 weeks)**

	VIREAD (N=368) (Week 0–24)	Placebo (N=182) (Week 0–24)	VIREAD (N=368) (Week 0–48)	Placebo Crossover to VIREAD (N=170) (Week 24–48)
<b>Body as a Whole</b>				
Asthenia	7%	6%	11%	1%
Pain	7%	7%	12%	4%
Headache	5%	5%	8%	2%
Abdominal Pain	4%	3%	7%	6%
Back Pain	3%	3%	4%	2%
Chest Pain	3%	1%	3%	2%
Fever	2%	2%	4%	2%
<b>Digestive System</b>				
Diarrhea	11%	10%	16%	11%
Nausea	8%	5%	11%	7%
Vomiting	4%	1%	7%	5%
Anorexia	3%	2%	4%	1%
Dyspepsia	3%	2%	4%	2%
Flatulence	3%	1%	4%	1%
<b>Respiratory</b>				
Pneumonia	2%	0%	3%	2%
<b>Nervous System</b>				
Depression	4%	3%	8%	4%
Insomnia	3%	2%	4%	4%
Peripheral Neuropathy <sup>1</sup>	3%	3%	5%	2%
Dizziness	1%	3%	3%	1%
<b>Skin and Appendage</b>				
Rash Event <sup>2</sup>	5%	4%	7%	1%
Sweating	3%	2%	3%	1%
<b>Musculoskeletal</b>				
Myalgia	3%	3%	4%	1%
<b>Metabolic</b>				
Weight Loss	2%	1%	4%	2%

1. Peripheral neuropathy includes peripheral neuritis and neuropathy.

2. Rash event includes rash, pruritus, maculopapular rash, urticaria, vesiculobullous rash, and pustular rash.

**Laboratory Abnormalities:** Laboratory abnormalities observed in this study occurred with similar frequency in the VIREAD and placebo-treated groups. A summary of Grade 3 and 4 laboratory abnormalities is provided in Table 12.

**Table 12. Grade 3/4 Laboratory Abnormalities Reported in ≥1% of VIREAD-Treated Patients in Study 907 (0–48 weeks)**

	VIREAD (N=368) (Week 0–24)	Placebo (N=182) (Week 0–24)	VIREAD (N=368) (Week 0–48)	Placebo Crossover to VIREAD (N=170) (Week 24–48)
	(%)	(%)	(%)	(%)
Any ≥ Grade 3 Laboratory Abnormality	25%	38%	35%	34%
Triglycerides (>750 mg/dL)	8%	13%	11%	9%
Creatine Kinase (M: >990U/L) (F: >845 U/L)	7%	14%	12%	12%
Serum Amylase (>175 U/L)	6%	7%	7%	6%
Urine Glucose (≥3+)	3%	3%	3%	2%
AST (M: >180 U/L) (F: >170 U/L)	3%	3%	4%	5%
ALT (M: >215 U/L) (F: >170 U/L)	2%	2%	4%	5%
Serum Glucose (>250 U/L)	2%	4%	3%	3%
Neutrophils (<750/mm <sup>3</sup> )	1%	1%	2%	1%

**Post Marketing Experience:** In addition to adverse events reported from clinical trials, the following events have been identified during post-approval use of VIREAD. Because they are reported voluntarily from a population of unknown size, estimates of frequency cannot be made. These events have been chosen for inclusion due to a combination of their seriousness, frequency of reporting or potential causal connection to VIREAD.

#### IMMUNE SYSTEM DISORDERS

Allergic reaction

#### METABOLISM AND NUTRITION DISORDERS

Hypophosphatemia, Lactic acidosis

#### RESPIRATORY, THORACIC, AND MEDIASTINAL DISORDERS

Dyspnea

#### GASTROINTESTINAL DISORDERS

Abdominal pain, Increased amylase, Pancreatitis

#### HEPATOBIILIARY DISORDERS

Increased liver enzymes, Hepatitis

#### RENAL AND URINARY DISORDERS

Renal insufficiency, Renal failure, Acute renal failure, Fanconi syndrome, Proximal tubulopathy, Proteinuria, Increased creatinine, Acute tubular necrosis, Nephrogenic diabetes insipidus

#### OVERDOSAGE

Limited clinical experience at doses higher than the therapeutic dose of VIREAD 300 mg is available. In Study 901, 600 mg tenofovir disoproxil fumarate was administered to 8 patients orally for 28 days. No severe adverse reactions were reported. The effects of higher doses are not known.

If overdose occurs the patient must be monitored for evidence of toxicity, and standard supportive treatment applied as necessary.

Tenofovir is efficiently removed by hemodialysis with an extraction coefficient of approximately 54%. Following a single 300 mg dose of VIREAD, a four-hour hemodialysis session removed approximately 10% of the administered tenofovir dose.

## DOSAGE AND ADMINISTRATION

The dose of VIREAD is 300 mg once daily taken orally, without regard to food.

### Dose Adjustment for Renal Impairment

Significantly increased drug exposures occurred when VIREAD was administered to patients with moderate to severe renal impairment (See PHARMACOKINETICS). The dosing interval of VIREAD should be adjusted in patients with baseline creatinine clearance <50 mL/min using the recommendations in Table 13. The safety and effectiveness of these dosing interval adjustment recommendations have not been clinically evaluated, therefore, clinical response to treatment and renal function should be closely monitored in these patients.

**Table 13. Dosage Adjustment for Patients with Altered Creatinine Clearance**

	Creatinine Clearance (mL/min) <sup>1</sup>			Hemodialysis Patients
	≥50	30–49	10–29	
<b>Recommended 300 mg Dosing Interval</b>	Every 24 hours	Every 48 hours	Twice a week	Every 7 days or after a total of approximately 12 hours of dialysis <sup>2</sup>

1. Calculated using ideal (lean) body weight.
2. Generally once weekly assuming three hemodialysis sessions a week of approximately 4 hours duration. VIREAD should be administered following completion of dialysis.

The pharmacokinetics of tenofovir have not been evaluated in non-hemodialysis patients with creatinine clearance <10 mL/min; therefore, no dosing recommendation is available for these patients.

## HOW SUPPLIED

VIREAD is available as tablets. Each tablet contains 300 mg of tenofovir disoproxil fumarate, which is equivalent to 245 mg of tenofovir disoproxil. The tablets are almond-shaped, light blue, film-coated, and debossed with “GILEAD” and “4331” on one side and with “300” on the other side. They are packaged as follows: Bottles of 30 tablets (NDC 61958-0401-1) containing a desiccant (silica gel canister or sachet) and closed with child-resistant closure.

Store at 25 °C (77 °F), excursions permitted to 15-30 °C (59-86 °F) (see USP Controlled Room Temperature).

**Do not use if seal over bottle opening is broken or missing.**

Gilead Sciences, Inc.  
Foster City, CA 94404

NDA 21-356/S-011

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## **VIREAD®**

(tenofovir disoproxil fumarate) Tablets

### **Patient Information**

## **VIREAD (VEER ee ad)**

Generic Name: tenofovir disoproxil fumarate (te NOE' fo veer dye soe PROX il FYOU-mar-ate)

Read this leaflet carefully before you start taking VIREAD. Also, read it each time you get your VIREAD prescription refilled, in case something has changed. This information does not take the place of talking with your healthcare provider when you start this medicine and at check ups. You should stay under a healthcare provider's care when taking VIREAD. Do not change or stop your medicine without first talking with your healthcare provider. Talk to your healthcare provider if you have any questions about VIREAD.

### ***What is VIREAD and how does it work?***

VIREAD IS A TYPE OF MEDICINE CALLED AN HIV-1 (HUMAN IMMUNODEFICIENCY VIRUS) NUCLEOTIDE ANALOG REVERSE TRANSCRIPTASE INHIBITOR (NRTI). VIREAD IS ALWAYS USED IN COMBINATION WITH OTHER ANTI-HIV MEDICINES TO TREAT PEOPLE WITH HIV-1 INFECTION. VIREAD IS FOR ADULTS AGE 18 AND OLDER.

HIV INFECTION DESTROYS CD4 (T) CELLS, WHICH ARE IMPORTANT TO THE IMMUNE SYSTEM. AFTER A LARGE NUMBER OF T CELLS ARE DESTROYED, ACQUIRED IMMUNE DEFICIENCY SYNDROME (AIDS) DEVELOPS.

VIREAD helps to block HIV-1 reverse transcriptase, a chemical in your body (enzyme) that is needed for HIV-1 to multiply. VIREAD lowers the amount of HIV-1 in the blood (called viral load) and may help to increase the number of T cells (called CD4 cells). Lowering the amount of HIV-1 in the blood lowers the chance of death or infections that happen when your immune system is weak (opportunistic infections).

### ***Does VIREAD cure HIV-1 or AIDS?***

*VIREAD does not cure HIV-1 infection or AIDS. The long-term effects of VIREAD are not known at this time. People taking VIREAD may still get opportunistic infections or other conditions that happen with HIV-1 infection. Opportunistic infections are infections that develop because the immune system is weak. Some of these conditions are pneumonia, herpes virus infections, and Mycobacterium avium complex (MAC) infections.*

### ***Does VIREAD reduce the risk of passing HIV-1 to others?***

*VIREAD does not reduce the risk of passing HIV-1 to others through sexual contact or blood contamination. Continue to practice safe sex and do not use or share dirty needles.*

### ***Who should not take VIREAD?***

TOGETHER WITH YOUR HEALTHCARE PROVIDER, YOU NEED TO DECIDE WHETHER VIREAD IS RIGHT FOR YOU.

Do not take VIREAD if

- you are allergic to VIREAD or any of its ingredients

### ***What should I tell my healthcare provider before taking VIREAD?***

*Tell your healthcare provider*

- *If you are pregnant or planning to become pregnant:* The effects of VIREAD on pregnant women or their unborn babies are not known.
- *If you are breast-feeding:* Do not breast-feed if you are taking VIREAD. Do not breast-feed if you have HIV. If you are a woman who has or will have a baby, talk with your healthcare provider about the best way to feed your baby. If your baby does not already have HIV, there is a chance that the baby can get HIV through breast-feeding.
- **If you have kidney or bone problems**
- **If you have liver problems including Hepatitis B Virus infection**
- **Tell your healthcare provider about all your medical conditions**
- **TELL YOUR HEALTHCARE PROVIDER ABOUT ALL THE MEDICINES YOU TAKE, INCLUDING PRESCRIPTION AND NON-PRESCRIPTION MEDICINES AND DIETARY SUPPLEMENTS. VIREAD MAY INCREASE THE AMOUNT OF VIDEX<sup>®</sup> (DIDANOSINE) IN YOUR BLOOD. YOU MAY NEED TO BE FOLLOWED MORE CAREFULLY IF YOU ARE TAKING THESE TWO DRUGS TOGETHER. IF YOU ARE TAKING VIDEX (DIDANOSINE) AND VIREAD TOGETHER YOUR HEALTHCARE PROVIDER MAY NEED TO REDUCE YOUR DOSE OF VIDEX (DIDANOSINE).**

VIREAD MAY DECREASE THE AMOUNT OF REYATAZ<sup>®</sup> (ATAZANAVIR) IN YOUR BLOOD. IF YOU ARE TAKING VIREAD AND REYATAZ (ATAZANAVIR) TOGETHER YOU SHOULD ALSO BE TAKING NORVIR<sup>®</sup> (RITONAVIR).

IT IS A GOOD IDEA TO KEEP A COMPLETE LIST OF ALL THE MEDICINES THAT YOU TAKE. MAKE A NEW LIST WHEN MEDICINES ARE ADDED OR STOPPED. GIVE COPIES OF THIS LIST TO ALL OF YOUR HEALTHCARE PROVIDERS **EVERY** TIME YOU VISIT YOUR HEALTHCARE PROVIDER OR FILL A PRESCRIPTION.

### ***How should I take VIREAD?***

- Stay under a healthcare provider's care when taking VIREAD. Do not change your treatment or stop treatment without first talking with your healthcare provider.



- Take VIREAD every day exactly as your healthcare provider prescribed it. Follow the directions from your healthcare provider, exactly as written on the label. Set up a dosing schedule and follow it carefully.
- The usual dose of VIREAD is 1 tablet once a day, in combination with other anti-HIV medicines. If you have kidney problems, your healthcare provider may recommend that you take VIREAD less frequently.
- VIREAD may be taken with or without a meal.
- When your VIREAD supply starts to run low, get more from your healthcare provider or pharmacy. This is very important because the amount of virus in your blood may increase if the medicine is stopped for even a short time. The virus may develop resistance to VIREAD and become harder to treat.
- *Only take medicine that has been prescribed specifically for you. Do not give VIREAD to others or take medicine prescribed for someone else.*

### ***What should I do if I miss a dose of VIREAD?***

*It is important that you do not miss any doses. If you miss a dose of VIREAD, take it as soon as possible and then take your next scheduled dose at its regular time. If it is almost time for your next dose, do not take the missed dose. Wait and take the next dose at the regular time. Do not double the next dose.*

### ***What happens if I take too much VIREAD?***

***If you suspect that you took more than the prescribed dose of VIREAD, contact your local poison control center or emergency room right away.***

*As with all medicines, VIREAD should be kept out of reach of children.*

### ***What should I avoid while taking VIREAD?***

- Do not breast-feed. See “What should I tell my healthcare provider before taking VIREAD?”

### ***What are the possible side effects of VIREAD?***

- *Clinical studies: The most common side effects of VIREAD are: diarrhea, nausea, vomiting, and flatulence (intestinal gas).*
- *Marketing experience: Other side effects reported since VIREAD has been marketed include: weakness, inflammation of the pancreas, low blood phosphate, dizziness, shortness of breath, and rash.*
- *Some patients treated with VIREAD have had kidney problems. If you have had kidney problems in the past or need to take another drug that can cause kidney problems, your healthcare provider may need to perform additional blood tests.*
- *Laboratory tests show changes in the bones of patients treated with VIREAD. It is not known whether long-term use of VIREAD will cause damage to your bones. If you have*

had bone problems in the past, your healthcare provider may need to perform additional tests or may suggest additional medication.

- Some patients taking antiviral drugs like VIREAD have developed a condition called lactic acidosis (a buildup in the blood of lactic acid, the same substance that causes your muscles to burn during heavy exercise). Symptoms of lactic acidosis include nausea, vomiting, unusual or unexpected stomach discomfort, and weakness. If you notice these symptoms or if your medical condition changes suddenly, call your healthcare provider right away.
- Changes in body fat have been seen in some patients taking anti-HIV medicine. These changes may include increased amount of fat in the upper back and neck (“buffalo hump”), breast, and around the main part of your body (trunk). Loss of fat from the legs, arms and face may also happen. The cause and long term health effects of these conditions are not known at this time.
- If you have hepatitis B virus (HBV) infection, you may have a “flare-up” of hepatitis B, in which the disease suddenly returns in a worse way than before if you stop taking VIREAD. VIREAD is not for the treatment of hepatitis B virus infection.
- There have been other side effects in patients taking VIREAD. However, these side effects may have been due to other medicines that patients were taking or to the illness itself. Some of these side effects can be serious.
- *This list of side effects is **not** complete. If you have questions about side effects, ask your healthcare provider. You should report any new or continuing symptoms to your healthcare provider right away. Your healthcare provider may be able to help you manage these side effects.*

### **How do I store VIREAD?**

- Keep VIREAD and all other medications out of reach of children.
- Store VIREAD at room temperature 77 °F (25 °C). It should remain stable until the expiration date printed on the label.
- Do not keep your medicine in places that are too hot or cold.
- *Do not keep medicine that is out of date or that you no longer need. If you throw any medicines away make sure that children will not find them.*

### **General advice about prescription medicines:**

TALK TO YOUR HEALTHCARE PROVIDER IF YOU HAVE ANY QUESTIONS ABOUT THIS MEDICINE OR YOUR CONDITION. MEDICINES ARE SOMETIMES PRESCRIBED FOR PURPOSES OTHER THAN THOSE LISTED IN A PATIENT INFORMATION LEAFLET. IF YOU HAVE ANY CONCERNS ABOUT THIS MEDICINE, ASK YOUR HEALTHCARE PROVIDER. YOUR HEALTHCARE PROVIDER OR PHARMACIST CAN GIVE YOU INFORMATION ABOUT THIS MEDICINE THAT WAS WRITTEN FOR HEALTH CARE PROFESSIONALS. DO NOT USE THIS MEDICINE FOR A CONDITION FOR WHICH IT WAS NOT PRESCRIBED. DO NOT SHARE THIS MEDICINE WITH OTHER PEOPLE.

DO NOT USE IF SEAL OVER BOTTLE OPENING IS BROKEN OR MISSING.

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