

Attachment 1: Product information for AusPAR Triumeq Dolutegravir sodium/abacavir sulfate/lamivudine ViiV Healthcare Pty Ltd PM-2013-04112-1-2 19 May 2015. This Product Information was approved at the time this AusPAR was published.

## PRODUCT INFORMATION

### TRIUMEQ<sup>â</sup> (dolutegravir, abacavir and lamivudine) Tablets

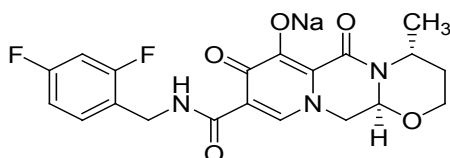
In clinical trials approximately 5% of patients who received abacavir, a component of TRIUMEQ tablets, developed a hypersensitivity reaction, which in rare cases has proved fatal. TRIUMEQ tablets, or any other medicinal product containing abacavir (KIVEXA<sup>®</sup> [abacavir/lamivudine], TRIZIVIR<sup>®</sup> [abacavir/lamivudine/zidovudine] and ZIAGEN<sup>®</sup> [abacavir]), **MUST NEVER** be restarted following a hypersensitivity reaction. (see Precautions and Adverse Effects).

### NAME OF THE MEDICINE

TRIUMEQ<sup>â</sup> film-coated tablets contain 50 mg of dolutegravir (as dolutegravir sodium), 600 mg of abacavir as abacavir sulfate and 300 mg of lamivudine. Product Information for TIVICAY<sup>â</sup> (dolutegravir), ZIAGEN<sup>â</sup> (abacavir), 3TC<sup>â</sup> (lamivudine) and KIVEXA<sup>â</sup> (abacavir and lamivudine) contain additional information.

The chemical (IUPAC) name for dolutegravir sodium is Sodium (4R,12aS)-9-[(2,4-difluorophenyl)methyl]carbamoyl}-4-methyl-6,8-dioxo-3,4,6,8,12,12a-hexahydro-2H-pyrido[1',2':4,5]pyrazino[2,1-b][1,3]oxazin-7-olate. It has a molecular formula of C<sub>20</sub>H<sub>18</sub>F<sub>2</sub>N<sub>3</sub>NaO<sub>5</sub> and a molecular weight of 441.36 g/mol.

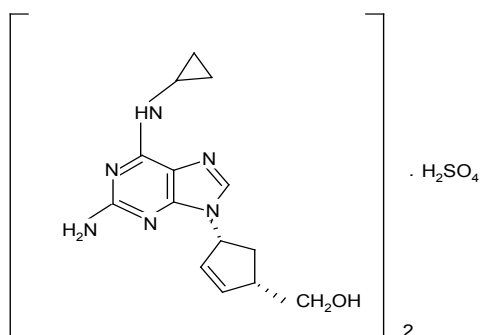
The structural formula is:



CAS Registry Number: 1051375-19-9

The chemical name of abacavir sulfate is (1*S*,*cis*)-4-[2-amino-6-(cyclopropylamino)-9*H*-purin-9-yl]-2-cyclopentene-1-methanol sulfate (salt) (2:1). Abacavir sulfate is the enantiomer with 1*S*, 4*R* absolute configuration on the cyclopentene ring. It has a molecular formula of (C<sub>14</sub>H<sub>18</sub>N<sub>6</sub>O)<sub>2</sub>·H<sub>2</sub>SO<sub>4</sub> and a molecular weight of 670.76 g/mol.

The structural formula is:

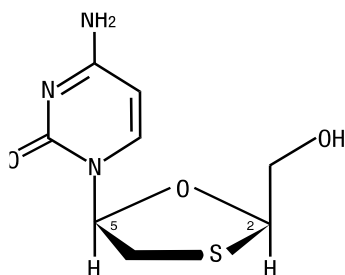


CAS Registry Number: 188062-50-2

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The chemical name of lamivudine is (2R,cis)-4-amino-1-[2- (hydroxymethyl)-1,3-oxathiolan-5-yl]-2(1H)-pyrimidinone. Lamivudine is the (-)-enantiomer of a dideoxy analogue of cytidine. Lamivudine has also been referred to as (-)-2',3'-dideoxy, 3'-thiacytidine. It has a molecular formula of C<sub>8</sub>H<sub>11</sub>N<sub>3</sub>O<sub>3</sub>S and a molecular weight of 229.3 g/mol.

The structural formula is:



CAS Registry Number: 134678-17-4

## DESCRIPTION

Dolutegravir sodium is a white to light yellow powder and is slightly soluble in water. The partition coefficient (log P) for dolutegravir sodium is 2.2 and the pKa is 8.2.

Abacavir sulfate is a white to off-white crystalline powder with a solubility of approximately 77 mg/mL in water at 25°C.

Lamivudine is a white to off-white crystalline solid which is highly soluble in water.

TRIUMEQ is supplied as film-coated tablets each containing 50 mg of dolutegravir (as dolutegravir sodium), 600 mg of abacavir as abacavir sulfate and 300 mg of lamivudine. TRIUMEQ tablets also contain: mannitol, microcrystalline cellulose, povidone, sodium starch glycolate, magnesium stearate, polyvinyl alcohol – part hydrolyzed, titanium dioxide, macrogol 3350, talc, iron oxide black, and iron oxide red.

## PHARMACOLOGY

### Mechanism of Action

Dolutegravir inhibits HIV integrase by binding to the integrase active site and blocking the strand transfer step of retroviral deoxyribonucleic acid (DNA) integration which is essential for the HIV replication cycle. Strand transfer biochemical assays using purified HIV-1 integrase and pre-processed substrate DNA resulted in IC<sub>50</sub> values of 2.7 nM and 12.6 nM. *In vitro*, dolutegravir dissociates slowly from the active site of the wild type integrase-DNA complex (t<sub>1/2</sub> 71 hours).

Abacavir and lamivudine are nucleoside reverse transcriptase inhibitors (NRTIs), and are potent, selective inhibitors of HIV-1 and HIV-2 replication. Both abacavir and lamivudine are metabolised sequentially by intracellular kinases to the respective triphosphate (TP) which are the active moieties with extended intracellular half-lives supporting once daily dosing (see *Pharmacokinetics - Excretion*). Lamivudine-TP and carbociclovir-TP (the active triphosphate form of abacavir) are substrates for and competitive inhibitors of HIV reverse transcriptase (RT), however their main antiviral activity is through incorporation of the

monophosphate form into the viral DNA chain, resulting in chain termination. Abacavir and lamivudine triphosphates show significantly less affinity for host cell DNA polymerases.

### **Pharmacodynamic Effects**

In a randomized, dose-ranging trial, HIV-1 infected patients treated with dolutegravir monotherapy (ING111521) demonstrated rapid and dose-dependent antiviral activity, with mean declines from baseline to day 11 in HIV-1 RNA of 1.5, 2.0, and 2.5 log<sub>10</sub> for dolutegravir 2 mg, 10 mg, and 50 mg once daily, respectively. This antiviral response was maintained for 3 to 4 days after the last dose in the 50 mg group.

### **Antiviral Activity of Dolutegravir in Cell Culture**

Dolutegravir exhibited antiviral activity against laboratory strains of wild type HIV-1 in peripheral blood mononuclear cells (PBMC) and MT4 cells with mean IC<sub>50</sub>s of 0.5 nM to 2.1 nM.

In a viral integrase susceptibility assay using the integrase coding region from 13 clinically diverse clade B isolates, dolutegravir demonstrated antiviral potency similar to laboratory strains, with a mean IC<sub>50</sub> of 0.52 nM.

When tested in PBMC assays against a panel consisting of 24 HIV-1 clinical isolates [group M (clade A, B, C, D, E, F and G) and group O] and 3 HIV-2 clinical isolates, the geometric mean IC<sub>50</sub> was 0.20 nM and IC<sub>50</sub> values ranged from 0.02 to 2.14 nM for HIV-1, while the geometric mean IC<sub>50</sub> was 0.18 nM and IC<sub>50</sub> values ranged from 0.09 to 0.61 nM for HIV-2 isolates.

### **Antiviral Activity of Dolutegravir in Combination with Other Antiviral Agents**

The antiviral activity of dolutegravir *in vitro* was not antagonistic with abacavir. *In vitro* data with dolutegravir combined with lamivudine are not available.

The antiviral activity of dolutegravir *in vitro* was not antagonistic with the integrase inhibitor (INI) raltegravir; the non-nucleoside reverse transcriptase inhibitors (NNRTIs) efavirenz or nevirapine; the nucleoside reverse transcriptase inhibitor (NRTI) abacavir, the protease inhibitors (PIs) amprenavir or lopinavir; the CCR5 co-receptor antagonist maraviroc, or the fusion inhibitor enfuvirtide. Dolutegravir antiviral activity was not antagonistic when combined with the HBV reverse transcriptase inhibitor adefovir, or inhibited by the antiviral ribavirin.

### **Effect of Human Serum and Serum Proteins**

The protein adjusted IC<sub>90</sub> (PA-IC<sub>90</sub>) in PBMCs for dolutegravir was estimated to be 64 ng/mL. Dolutegravir trough concentration for a single 50 mg dose in integrase inhibitor naïve subjects was 1.20 ng/mL, 19 times higher than the estimated PA-IC<sub>90</sub>.

Plasma protein binding studies *in vitro* indicate that abacavir binds only low to moderately (~49%) to human plasma proteins at therapeutic concentrations.

Lamivudine exhibits linear pharmacokinetics over the therapeutic dose range and displays low plasma protein binding (less than 36%).

### **Resistance *in vitro* (Dolutegravir)**

Dolutegravir-resistant viruses were selected in studies of potential resistance using different wild type strains and clades of HIV-1. Amino acid substitutions that emerged during passaging included E92Q, G193E, G118R, S153F or Y, and R263K, and were associated with decreased susceptibility to dolutegravir of up to 11-fold.

In resistance development studies starting with the single raltegravir resistance mutants Q148H, Q148K or Q148R, additional mutations detected during passage with dolutegravir

included E138K/Q148K, E138K/Q148R, Q140S/Q148R and G140S/Q148R, which all exhibited greater than ten-fold reductions in sensitivity to dolutegravir.

### ***Resistance in vivo (Dolutegravir): Integrase Inhibitor Naïve Patients***

No INI-resistant mutations or treatment emergent resistance to the NRTI backbone therapy were isolated with dolutegravir 50 mg once daily in treatment-naïve studies [SPRING-1 (ING112276), SPRING-2 (ING113086), SINGLE (ING114467) and FLAMINGO (ING114915) studies]. In the SAILING study for treatment experienced (and integrase naïve) patients (n=354 in the dolutegravir arm), treatment emergent integrase substitutions were observed at Week 48 in 4 of 17 patients with virologic failure in the dolutegravir arm. Of these four, 2 patients had a unique R263K integrase substitution, with a maximum FC of 1.93, 1 patient had a polymorphic V151V/I integrase substitution, with maximum FC of 0.92, and 1 patient had pre-existing integrase mutations and is assumed to have been integrase experienced or infected with integrase resistant virus by transmission (see *Clinical Trials*).

### ***Resistance in vitro and in vivo (Abacavir and Lamivudine)***

HIV-1 resistance to lamivudine involves the development of a M184V amino acid change close to the active site of the viral RT. This variant arises both *in vitro* and in HIV-1 infected patients treated with lamivudine-containing antiretroviral therapy. M184V mutants display greatly reduced susceptibility to lamivudine and show diminished viral replicative capacity *in vitro*. Studies *in vitro* indicate that zidovudine-resistant virus isolates can become zidovudine sensitive when they simultaneously acquire resistance to lamivudine. The clinical relevance of such findings remains, however, not well defined.

Genetic analysis of isolates from patients failing an abacavir-containing regimen demonstrated that reverse transcriptase amino acid residue 184 was consistently the most frequent position for NRTI resistance-associated mutations (M184V or M184I). The second most frequent mutation was L74V. Mutations Y115F and K65R were uncommon. Viral resistance to abacavir develops relatively slowly *in vitro* and *in vivo*, requiring multiple mutations to reach an eight-fold increase in IC<sub>50</sub> over wild-type virus, which may be a clinically relevant level.

### **Cross-Resistance**

Cross-resistance has been observed among nucleoside reverse transcriptase inhibitors. Viruses containing abacavir and lamivudine resistance-associated mutations, namely, M184V, L74V, Y115F and K65R, exhibit cross-resistance to didanosine, emtricitabine, lamivudine, tenofovir, and zalcitabine *in vitro* and in patients. The M184V mutation can confer resistance to abacavir, didanosine, emtricitabine, lamivudine, and zalcitabine; the L74V mutation can confer resistance to abacavir, didanosine, and zalcitabine and the K65R mutation can confer resistance to abacavir, didanosine, emtricitabine, lamivudine, stavudine, tenofovir, and zalcitabine. The combination of abacavir/lamivudine has demonstrated decreased susceptibility to viruses with the L74V plus the M184V/I mutation, viruses with K65R with or without the M184V/I mutation, and viruses with thymidine analog mutations (TAMs: M41L, D67N, K70R, L210W, T215Y/F, K219 E/R/H/Q/N) plus M184V. An increasing number of TAMs is associated with a progressive reduction in abacavir susceptibility.

### ***Effects on Electrocardiogram***

In a randomized, placebo-controlled, cross-over trial, 42 healthy patients received single dose oral administrations of placebo, dolutegravir 250 mg suspension (exposures approximately 3-fold of the 50 mg once-daily dose at steady state), and moxifloxacin (400 mg, active control) in random sequence. Dolutegravir did not prolong the QTc interval for 24 hours post dose. After baseline and placebo adjustment, the maximum

mean QTc change based on Fridericia correction method (QTcF) was 1.99 msec (1-sided 95% upper CI: 4.53 msec).

Similar studies were not conducted with either abacavir or lamivudine.

### **Effects on Renal Function**

The effect of dolutegravir on serum creatinine clearance (CrCl), glomerular filtration rate (GFR) using iohexol as the probe and effective renal plasma flow (ERPF) using para-aminohippurate (PAH) as the probe was evaluated in an open-label, randomized, 3 arm, parallel, placebo-controlled study in 37 healthy patients, who were administered dolutegravir 50 mg once daily (n=12), 50 mg twice daily (n=13) or placebo once daily (n=12) for 14 days. A modest decrease in CrCl was observed with dolutegravir within the first week of treatment, consistent with that seen in clinical studies. Dolutegravir at both doses had no significant effect on GFR or ERPF. These data support *in vitro* studies which suggest that the small increases in creatinine observed in clinical studies are due to the nonpathologic inhibition of the organic cation transporter 2 (OCT2) in the proximal renal tubules, which mediates the tubular secretion of creatinine.

### **Pharmacokinetics**

TRIUMEQ has been shown to be bioequivalent to dolutegravir single entity tablet with abacavir/lamivudine fixed dose combination tablet administered separately. This was demonstrated in a single dose, 2-way crossover bioequivalence study of TRIUMEQ (fasted) versus 1 x 50 mg dolutegravir tablet, plus 1 x 600mg abacavir/300 mg lamivudine tablet (fasted) in healthy patients (n=62). In a separate cohort there was no clinically significant effect of a high fat meal on the exposure of dolutegravir, lamivudine or abacavir. These results indicate that TRIUMEQ can be taken with or without food.

The pharmacokinetic properties of dolutegravir, lamivudine and abacavir are described below.

#### **Absorption**

Dolutegravir is rapidly absorbed following oral administration [See TIVICAY [dolutegravir] PI, Pharmacology, Absorption]. The absolute bioavailability of dolutegravir has not been established [See TIVICAY [dolutegravir] PI, Pharmacology, Absorption]. The mean time to maximal serum concentrations ( $t_{max}$ ) is about 2 to 3 hours (post dose for tablet formulation) for dolutegravir [See TIVICAY [dolutegravir] PI, Pharmacology, Absorption]. Following multiple oral doses of dolutegravir 50mg once daily, the geometric mean steady state pharmacokinetic parameter estimates are 53.6 micrograms.h/mL for AUC<sub>24</sub>, 3.67 microgram/mL for C<sub>max</sub>, and 1.11 microgram/mL for C<sub>24</sub> based on population pharmacokinetic analysis in treatment-naïve subjects.

Abacavir is rapidly absorbed following oral administration. The absolute bioavailability of oral abacavir is 83%. Following a single oral dose of 600 mg of abacavir, the mean C<sub>max</sub> is 4.26 micrograms/ml and the mean AUC<sub>∞</sub> is 11.95 micrograms.h/ml.

Lamivudine is rapidly absorbed following oral administration. The absolute bioavailability of oral lamivudine in adults is 80 to 85% respectively. Following multiple-dose oral administration of lamivudine 300 mg once daily for seven days the mean steady-state C<sub>max</sub> is 2.04 micrograms/ml and the mean AUC<sub>24</sub> is 8.87 micrograms.h/ml.

#### **Distribution**

The apparent volume of distribution of dolutegravir (following oral administration of suspension formulation, Vd/F) is estimated at 12.5 L. Dolutegravir is highly bound (approximately 99.3%) to human plasma proteins based on *in vitro* data. Binding of

dolutegravir to plasma proteins was independent of concentration. Total blood and plasma drug-related radioactivity concentration ratios averaged between 0.441 to 0.535 indicating minimal association of radioactivity with blood cellular components. Free fraction of dolutegravir in plasma is estimated at approximately 0.2 to 1.1% in healthy patients, approximately 0.4 to 0.5% in patients with moderate hepatic impairment, and 0.8 to 1.0% in patients with severe renal impairment and 0.5% in HIV-1 infected patients

Intravenous studies with abacavir showed that the mean apparent volume of distribution is 0.8. Plasma protein binding studies *in vitro* indicate that abacavir binds only low to moderately (approximately 49%) to human plasma proteins at therapeutic concentrations.

Intravenous studies with lamivudine showed that the mean apparent volume of distribution is 1.3 l/kg. Lamivudine exhibits linear pharmacokinetics over the therapeutic dose range and displays low plasma protein binding (less than 36%).

Dolutegravir, abacavir and lamivudine are present in cerebrospinal fluid (CSF). In 12 treatment-naïve patients receiving a regimen of dolutegravir plus abacavir/lamivudine for 16 weeks, dolutegravir concentration in CSF averaged 16.2 ng/mL at Week 2 and 12.6 ng/mL at Week 16, ranging from 3.7 to 23.2 ng/mL (comparable to unbound plasma concentration; 16.8 ng/mL at week 2 and 23 ng/mL at week 16, ranging from 3.81 to 32.1 ng/mL). CSF:plasma concentration ratio of dolutegravir ranged from 0.11 to 2.04%. Dolutegravir concentrations in CSF exceeded the IC<sub>50</sub> (0.52nM=0.2ng/mL), supporting the median reduction from baseline in CSF HIV-1 RNA of 2.2 log after 2 weeks and 3.4 log after 16 weeks of therapy.

Studies with abacavir demonstrate a CSF to plasma AUC ratio of between 30 to 44%. The observed values of the peak concentrations are 9 fold greater than the IC<sub>50</sub> of abacavir of 0.08 micrograms/ml or 0.26 micromolar when abacavir is given at 600 mg twice daily.

The mean ratio of CSF/serum lamivudine concentrations 2 to 4 h after oral administration was approximately 12%. The true extent of CNS penetration of lamivudine and its relationship with any clinical efficacy is unknown.

Dolutegravir is present in the female and male genital tract. AUC in cervicovaginal fluid, cervical tissue, and vaginal tissue were 6 to 10% of that in corresponding plasma at steady-state. AUC was 7% in semen and 17% in rectal tissue, of those in corresponding plasma at steady-state.

### **Metabolism**

Dolutegravir is primarily metabolized via UGT1A1 with a minor CYP3A component (9.7% of total dose administered in a human mass balance study). Dolutegravir is the predominant circulating compound in plasma; renal elimination of unchanged drug is low (<1% of the dose). Fifty-three percent of total oral dose is excreted unchanged in the faeces. It is unknown if all or part of this is due to unabsorbed drug or biliary excretion of the glucuronidate conjugate, which can be further degraded to form the parent compound in the gut lumen. Thirty-one percent of the total oral dose is excreted in the urine, represented by ether glucuronide of dolutegravir (18.9% of total dose), N-dealkylation metabolite (3.6% of total dose), and a metabolite formed by oxidation at the benzylic carbon (3.0% of total dose).

Abacavir is primarily metabolised by the liver with less than 2% of the administered dose being renally excreted as unchanged compound. The primary pathways of metabolism in man are by alcohol dehydrogenase and by glucuronidation to produce the 5'-carboxylic acid and 5'-glucuronide which account for about 66% of the administered dose. These metabolites are excreted in the urine.

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Metabolism of lamivudine is a minor route of elimination. Lamivudine is predominately cleared unchanged by renal excretion. The likelihood of metabolic interactions with lamivudine is low due to the small extent of hepatic metabolism (less than 10%).

### Excretion

Dolutegravir has a terminal half-life of ~14 hours and an apparent clearance (CL/F) of 0.56 L/hr.

The mean half-life of abacavir is about 1.5 hours. The geometric mean terminal half-life of intracellular carbovir-TP at steady-state is 20.6 hours. Following multiple oral doses of abacavir 300 mg twice a day, there is no significant accumulation of abacavir. Elimination of abacavir is via hepatic metabolism with subsequent excretion of metabolites primarily in the urine. The metabolites and unchanged abacavir account for about 83% of the administered abacavir dose in the urine. The remainder is eliminated in the faeces.

The observed lamivudine half-life of elimination is 5 to 7 hours. For patients receiving lamivudine 300 mg once daily, the terminal intracellular half-life of lamivudine-TP was prolonged to 16 to 19 hours. The mean systemic clearance of lamivudine is approximately 0.32 l/h/kg, predominantly by renal clearance (greater than 70%) via the organic cationic transport system.

### Special Patient Populations

#### Children

In a paediatric study including 23 antiretroviral treatment-experienced HIV-1 infected children and adolescents aged 12 to 18 years of age, the pharmacokinetics of dolutegravir was evaluated in 10 children and showed that dolutegravir 50 mg once daily dosage resulted in dolutegravir exposure in paediatric patients comparable to that observed in adults who received dolutegravir 50 mg once daily (Table 1).

**Table 1 Paediatric pharmacokinetic parameters (n=10)**

Age/weight	Dolutegravir Dose	Dolutegravir Pharmacokinetic Parameter Estimates Geometric Mean (CV%)		
		AUC <sub>(0-24)</sub> mg.hr/mL	C <sub>max</sub> mg/mL	C <sub>24</sub> mg/mL
12 to <18 years <sup>3</sup> 40 kg <sup>a</sup>	50 mg once daily <sup>a</sup>	46 (43)	3.49 (38)	0.90 (59)

<sup>a</sup>One patient weighing 37 kg received 35 mg once daily.

Limited data are available in adolescents receiving a daily dose of 600 mg of abacavir and 300 mg of lamivudine. Pharmacokinetic parameters are comparable to those reported in adults.

#### Elderly

Population pharmacokinetic analysis of dolutegravir using data in HIV-1 infected adults showed that there was no clinically relevant effect of age on dolutegravir exposure.

Pharmacokinetic data for dolutegravir, abacavir and lamivudine in patients of >65 years old are limited.

#### Hepatically Impaired

Pharmacokinetic data has been obtained for dolutegravir, abacavir and lamivudine alone. Based on data obtained for abacavir, TRIUMEQ is not recommended in patients with moderate and severe hepatic impairment.

Abacavir is metabolised primarily by the liver. The pharmacokinetics of abacavir have been studied in patients with mild hepatic impairment (Child-Pugh score 5 to 6). The results showed that there was a mean increase of 1.89 fold in the abacavir AUC and 1.58 fold in the half-life of abacavir. The AUCs of the metabolites were not modified by the liver disease. However, the rates of formation and elimination of these were decreased. Dosage reduction of abacavir may be required in patients with mild hepatic impairment. The separate preparation of abacavir should therefore be used to treat these patients. The pharmacokinetics of abacavir have not been studied in patients with moderate or severe hepatic impairment. Plasma concentrations of abacavir are expected to be variable and substantially increased in these patients. TRIUMEQ is therefore not recommended in patients with moderate and severe hepatic impairment.

Data obtained for lamivudine in patients with moderate to severe hepatic impairment and for dolutegravir in patients with moderate hepatic impairment show that the pharmacokinetics are not significantly affected by hepatic dysfunction.

Dolutegravir is primarily metabolized and eliminated by the liver. In a study comparing 8 patients with moderate hepatic impairment (Child-Pugh category B) to 8 matched healthy adult controls, the single 50 mg dose exposure of dolutegravir was similar between the two groups. The effect of severe hepatic impairment on the pharmacokinetics of dolutegravir has not been studied.

### ***Renally Impaired***

Pharmacokinetic data have been obtained for dolutegravir, abacavir and lamivudine alone.

TRIUMEQ should not be used in patients with creatinine clearance of less than 50 mL/min because, whilst no dosage adjustment of dolutegravir or abacavir is necessary in patients with renal impairment, dose reduction is required for the lamivudine component. Therefore the separate preparation of lamivudine should be used to treat these patients.

Studies with lamivudine show that plasma concentrations (AUC) are increased in patients with renal dysfunction due to decreased clearance.

Abacavir is primarily metabolised by the liver, with approximately 2% of abacavir excreted unchanged in the urine. The pharmacokinetics of abacavir in patients with end-stage renal disease is similar to patients with normal renal function.

Renal clearance of unchanged drug is a minor pathway of elimination for dolutegravir. A study of the pharmacokinetics of dolutegravir was performed in patients with severe renal impairment (CL<sub>cr</sub> <30 mL/min). No clinically important pharmacokinetic differences between patients with severe renal impairment (CL<sub>cr</sub> <30 mL/min) and matching healthy patients were observed. Dolutegravir has not been studied in patients on dialysis, though differences in exposure are not expected.

### ***Polymorphisms in Drug Metabolising Enzymes***

There is no evidence that common polymorphisms in drug metabolising enzymes alter dolutegravir pharmacokinetics to a clinically meaningful extent. In a meta-analysis using pharmacogenomics samples collected in clinical studies in healthy patients, patients with UGT1A1 (n=7) genotypes conferring poor dolutegravir metabolism had a 32% lower clearance of dolutegravir and 46% higher AUC compared with patients with genotypes associated with normal metabolism via UGT1A1 (n=41). Polymorphisms in CYP3A4, CYP3A5, and NR1I2 were not associated with differences in the pharmacokinetics of dolutegravir.



### **Gender**

The dolutegravir exposure in healthy patients appear to be slightly higher (~20%) in women than men based on data obtained in a healthy patient study (males n=17, females n=24). Population PK analyses using pooled pharmacokinetic data from Phase IIb and Phase III adult trials revealed no clinically relevant effect of gender on the exposure of dolutegravir.

There is no evidence that a dose adjustment of dolutegravir, abacavir or lamivudine would be required based on the effects of gender on PK parameters.

### **Race**

Population PK analyses using pooled pharmacokinetic data from Phase IIb and Phase III adult trials revealed no clinically relevant effect of race on the exposure of dolutegravir. The pharmacokinetics of dolutegravir following single dose oral administration to Japanese patients appear similar to observed parameters in Western (US) patients.

There is no evidence that a dose adjustment of dolutegravir, abacavir or lamivudine would be required based on the effects of race on PK parameters.

### **Co-infection with Hepatitis B or C**

Population PK analysis indicated that hepatitis C virus co-infection had no clinically relevant effect on the exposure to dolutegravir. There are limited pharmacokinetic data on patients with hepatitis B co-infection (see *Precautions*).

## **CLINICAL TRIALS**

TRIUMEQ is a film-coated tablet containing an integrase inhibitor (dolutegravir) and two NRTIs (abacavir and lamivudine).

The efficacy of TRIUMEQ is supported by data from a randomized, controlled trial in antiretroviral treatment-naïve subjects, SINGLE (ING114467) and other trials in treatment-naïve subjects (refer to the TIVICAY [dolutegravir] PI). The efficacy of dolutegravir, in combination with at least two active background regimens in treatment-experienced, INI-naïve subjects is supported by data from SAILING (ING111762) (refer to the TIVICAY [dolutegravir] PI).

### **Antiretroviral Naïve Patients**

In SINGLE (ING114467), 833 patients were randomized and received at least one dose of either dolutegravir 50 mg once daily with fixed-dose abacavir sulphate and lamivudine or fixed dose efavirenz-tenofovir-emtricitabine (EFV/TDF/FTC). At baseline, median patient age was 35 years, 16% were female, 32% non-white, 7% had hepatitis C co-infection and 4% were CDC Class C, these characteristics were similar between treatment groups.

Virologic outcomes (including outcomes by key baseline covariates) are described below.

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**Table 2 Virologic Outcomes of Randomized Treatment of SINGLE (ING114467) at 48 Weeks (Snapshot algorithm – missing or discontinuation = failure)**

	48 Weeks	
	DTG + ABC/3TC Once Daily N=414	EFV/TDF/FTC Once Daily N=419
Virologic Success HIV-1 RNA <50 copies/mL	88%	81%
Treatment Difference*	7.4% (95% CI: 2.5%, 12.3%)	
Virologic non response†	5%	6%
No virologic data at Weeks 48 window	7%	13%
<u>Reasons</u>		
Discontinued study/study drug due to adverse event or death‡	2%	10%
Discontinued study/study drug for other reasons§	5%	3%
Missing data during window but on study	0	<1%
<b>HIV-1 RNA&lt;50 copies/mL by baseline covariates</b>		
<b>Baseline Plasma Viral Load (copies/mL)</b>	<b>n / N (%)</b>	<b>n / N (%)</b>
£100,000	253 / 280 (90%)	238 / 288 (83%)
>100,000	111 / 134 (83%)	100 / 131 (76%)
<b>Baseline CD4+ (cells/ mm<sup>3</sup>)</b>		
<200	45 / 57 (79%)	48 / 62 (77%)
200 to <350	143 / 163 (88%)	126 / 159 (79%)
³ 350	176 / 194 (91%)	164 / 198 (83%)
<b>Gender</b>		
Male	307 / 347 (88%)	291 / 356 (82%)
Female	57 / 67 (85%)	47 / 63 (75%)
<b>Race</b>		
White	255 / 284 (90%)	238 / 285 (84%)
African-American/African Heritage/Other	109 / 130 (84%)	99 / 133 (74%)
<b>Age (years)</b>		
<50	319 / 361 (88%)	302 / 375 (81%)
³ 50	45 / 53 (85%)	36 / 44 (82%)
<p>* Adjusted for baseline stratification factors.  † Includes patients who discontinued prior to Week 48 for lack or loss of efficacy and patients who are <sup>3</sup> 50 copies in the 48 week window.  ‡ Includes patients who discontinued due to an adverse event or death at any time point from Day 1 through the Week 48 analysis window if this resulted in no virologic data on treatment during the analysis window.  § Includes reasons such as withdrew consent, loss to follow-up, moved, protocol deviation.  Notes: ABC/3TC = abacavir 600 mg, lamivudine 300 mg  EFV/TDF/FTC = efavirenz 600 mg, tenofovir 300 mg, emtricitabine 200 mg  N = Number of patients in each treatment group</p>		

In the primary 48 weeks analysis in the SINGLE study, the proportion of patients with virologic suppression (HIV-1 RNA <50 copies/mL using a missing or discontinuation =

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failure analysis) in the dolutegravir + ABC/3TC arm (88%), was superior to the EFV/TDF/FTC arm (81%),  $p=0.003$ . Similar treatment difference was observed in patients defined by baseline HIV-RNA level ( $<$  or  $>$  100,000 copies/mL). The median time to viral suppression was 28 days in the group receiving dolutegravir + ABC/3TC and 84 days in the EFV/TDF/FTC arm ( $p<0.0001$ ). The adjusted mean change in CD4+ T cell count from baseline were 267 cells/mm<sup>3</sup> in the group receiving dolutegravir + ABC/3TC and 208 cells/mm<sup>3</sup> for the EFV/TDF/FTC arm in SINGLE at 48 week [adjusted difference between arm (with 95% CI), 58.9 cells (33.4 cells to 84.4 cells),  $p<0.001$ ]. Both the time to viral suppression and change from baseline analyses were pre-specified and adjusted for multiplicity.

At 96 weeks, 80% of study participants on the dolutegravir+ ABC/3TC regimen were virologically suppressed ( $<50$  copies/mL using a missing or discontinuation = failure analysis) vs. 72% of participants on EFV/TDF/FTC [difference and 95% CI; 8.0% (+2.3% to +13.8%)]. The higher responses on dolutegravir + ABC/3TC were driven by withdrawals due to AEs and missing data.

### **Children**

In a Phase I/II 48 week multicentre, open-label study (P1093/ING112578), the pharmacokinetic parameters, safety, tolerability and efficacy of dolutegravir was evaluated in combination regimens in HIV-1 infected infants, children and adolescents.

At 24 weeks, 16 of 23 (69%) adolescents (12 to less than 18 years of age) treated with dolutegravir once daily (35 mg  $n=4$ , 50 mg  $n=19$ ) plus optimised background regimen achieved viral load less than 50 copies/mL.

### **INDICATIONS**

TRIUMEQ is indicated for the treatment of Human Immunodeficiency Virus (HIV) infection in adults and adolescents from 12 years of age who are antiretroviral treatment-naïve or are infected with HIV without documented or clinically suspected resistance to any of the three antiretroviral agents (dolutegravir, abacavir or lamivudine) in TRIUMEQ.

### **CONTRAINDICATIONS**

TRIUMEQ is contraindicated in patients with known hypersensitivity to dolutegravir, abacavir or lamivudine, or to any of the excipients (*See Description*).

TRIUMEQ is contraindicated in combination with dofetilide or pilsicainide.

### **PRECAUTIONS**

The special warnings and precautions relevant to dolutegravir, abacavir and lamivudine are included in this section. There are no additional precautions and warnings relevant to TRIUMEQ.

#### **Hypersensitivity Reactions**

**Hypersensitivity to Abacavir** (see also *Adverse Effects*).

Overall, in clinical studies conducted before the introduction of screening for the HLA-B\*5701 allele, approximately 5% of patients receiving abacavir developed a hypersensitivity reaction, which in rare cases has proved fatal.

- **Risk Factors**

Studies have shown that carriage of the HLA-B\*5701 allele is associated with a significantly increased risk of a hypersensitivity reaction to abacavir. In the prospective study CNA106030 (PREDICT-1), use of pre-therapy screening for the HLA-B\*5701 allele and subsequently avoiding abacavir in patients with this allele reduced the incidence of clinically suspected abacavir hypersensitivity reactions from 7.8% (66 of 847) to 3.4% (27 of 803) ( $p < 0.0001$ ) and the incidence of hypersensitivity reactions confirmed by skin patch testing from 2.7% (23 of 842) to 0.0% (0 of 802) ( $p < 0.0001$ ). Based on this study, it is estimated that 48% to 61% of patients with the HLA-B\*5701 allele will develop a hypersensitivity reaction during the course of abacavir treatment compared with 0% to 4% of patients who do not have the HLA-B\*5701 allele.

Clinicians should consider screening for carriage of the HLA-B\*5701 allele in any HIV infected patient without prior exposure to abacavir. Screening is recommended prior to re-initiation of abacavir in patients of unknown HLA-B\*5701 status who have previously tolerated abacavir (see *Special considerations following an interruption of abacavir therapy*). Use of abacavir in patients known to carry the HLA-B\*5701 allele is not recommended and should be considered only under exceptional circumstances where potential benefit outweighs the risk and with close medical supervision.

In any patient treated with abacavir, the clinical diagnosis of suspected hypersensitivity reaction must remain the basis of clinical decision making. Even in the absence of the HLA-B\*5701 allele, it is important to permanently discontinue abacavir and not rechallenge with abacavir if a hypersensitivity reaction cannot be ruled out on clinical grounds, due to the potential for a severe or even fatal reaction.

- **Clinical Description**

The hypersensitivity reaction is characterised by the appearance of symptoms indicating multi-organ involvement. The majority of patients have fever and/or rash as part of the syndrome.

Some of the other symptoms of hypersensitivity may include fatigue, malaise, gastrointestinal symptoms, such as nausea, vomiting, diarrhoea, or abdominal pain, and respiratory signs and symptoms such as dyspnoea, sore throat, cough and abnormal chest x-ray findings (predominantly infiltrates, which can be localised). **The symptoms of this hypersensitivity reaction can occur at any time during treatment with abacavir**, but usually occur within the first six weeks of therapy. The symptoms worsen with continued therapy and can be life-threatening. These symptoms usually resolve upon discontinuation of abacavir. Other frequently observed signs or symptoms of the hypersensitivity reaction may include pruritus, chills and musculoskeletal symptoms (rarely myolysis, arthralgia) (see *Adverse Effects*).

- ***Clinical Management***

Regardless of their HLA-B\*5701 status, any patient developing signs or symptoms of hypersensitivity **MUST** contact their doctor immediately for advice. If a hypersensitivity reaction is diagnosed **TRIUMEQ MUST** be discontinued immediately. **TRIUMEQ**, or any other medicinal product containing abacavir (e.g. **ZIAGEN [abacavir]**, **KIVEXA [abacavir/lamivudine]**, **TRIZIVIR [abacavir/lamivudine/zidovudine]**), **MUST NEVER** be restarted following a hypersensitivity reaction, as more severe symptoms will recur within hours and may include life-threatening hypotension and death.

To avoid a delay in diagnosis and minimise the risk of a life-threatening hypersensitivity reaction, **TRIUMEQ** should be permanently discontinued if hypersensitivity cannot be ruled out, even when other diagnoses are possible (respiratory diseases, flu-like illness, gastroenteritis or reactions to other medications). **TRIUMEQ**, or any other medicinal product containing abacavir (e.g. **ZIAGEN [abacavir]**, **KIVEXA [abacavir/lamivudine]**, **TRIZIVIR [abacavir/lamivudine/zidovudine]**), should not be restarted even if a recurrence of symptoms occurs following rechallenge with alternative medication(s).

**An Alert Card with information for the patient about this hypersensitivity reaction is included in the TRIUMEQ carton.**

- ***Special Considerations Following an Interruption of TRIUMEQ***

Regardless of a patient's HLA-B\*5701 status, if therapy with any abacavir containing product has been discontinued and restarting therapy with **TRIUMEQ** is under consideration, the reason for discontinuation should be evaluated to ensure that the patient did not have symptoms of a hypersensitivity reaction. **If a hypersensitivity reaction cannot be ruled out, TRIUMEQ or any other medicinal product containing abacavir (e.g. ZIAGEN [abacavir], KIVEXA [abacavir/lamivudine], TRIZIVIR [abacavir/lamivudine/zidovudine]) should not be restarted.**

There have been infrequent reports of hypersensitivity reactions with a rapid onset, including life threatening reactions, following reintroduction of abacavir in patients who had only one of the key symptoms of a hypersensitivity reaction (ie rash, fever, gastrointestinal, respiratory or constitutional symptoms such as fatigue or malaise). When patients who have discontinued **TRIUMEQ** present with an indeterminate diagnosis of hypersensitivity (single symptom), the doctor should:

- Assess the probability that hypersensitivity preceded the interruption
- Assess the risk:benefit of reinitiating **TRIUMEQ**
- Select a medical setting in which medical care can be accessed readily, if a decision is made to reintroduce **TRIUMEQ**.

Screening for carriage of the HLA-B\*5701 allele is recommended prior to re-initiation of abacavir in patients of unknown HLA-B\*5701 status who have previously tolerated abacavir. Re-initiation of abacavir in such patients who test positive for the HLA-B\*5701 allele is not recommended and should be considered only under exceptional circumstances where potential benefit outweighs the risk and with close medical supervision.

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• **Essential Patient Information**

Prescribers must ensure that patients are fully informed regarding the following information on the hypersensitivity reaction:

Patients must be made aware of the possibility of a hypersensitivity reaction to abacavir that may result in a life-threatening reaction or death and that the risk of a hypersensitivity reaction is increased if they are HLA-B\*5701 positive.

Patients must also be informed that HLA-B\*5701 negative patients can also experience abacavir hypersensitivity reaction. Therefore, ANY patient who develops signs or symptoms consistent with a possible hypersensitivity reaction to abacavir MUST CONTACT their doctor IMMEDIATELY.

Patients who are hypersensitive to abacavir should be reminded that they must never take TRIUMEQ or any other medicinal product containing abacavir (e.g. ZIAGEN [abacavir], KIVEXA [abacavir/lamivudine], TRIZIVIR [abacavir/lamivudine/zidovudine]) again, regardless of their HLA-B\*5701 status.

In order to avoid restarting TRIUMEQ, patients who have experienced a hypersensitivity reaction should be asked to return the remaining TRIUMEQ tablets to the pharmacy

Patients who have stopped TRIUMEQ for any reason, and particularly due to possible adverse reactions or illness, must be advised to contact their doctor before restarting

Each patient should be reminded to read the package leaflet included in the TRIUMEQ carton. They should be reminded of the importance of removing the Alert Card included in the carton, and keeping it with them at all times.

### **Hypersensitivity to Dolutegravir**

Hypersensitivity reactions have been reported with integrase inhibitors, including dolutegravir, and were characterized by rash, constitutional findings, and sometimes, organ dysfunction, including liver injury. Discontinue TRIUMEQ and other suspect agents immediately if signs or symptoms of hypersensitivity reactions develop (including, but not limited to, severe rash or rash accompanied by fever, general malaise, fatigue, muscle or joint aches, blisters, oral lesions, conjunctivitis, facial oedema, hepatitis, eosinophilia, angioedema). Clinical status including liver aminotransferases should be monitored and appropriate therapy initiated. Delay in stopping treatment with TRIUMEQ or other suspect agents after the onset of hypersensitivity may result in a life-threatening reaction.

### **Lactic Acidosis/Severe Hepatomegaly with Steatosis**

Lactic acidosis and severe hepatomegaly with steatosis, including fatal cases, have been reported with the use of antiretroviral nucleoside analogues either alone or in combination, including abacavir and lamivudine. A majority of these cases have been in women.

Clinical features which may be indicative of the development of lactic acidosis include generalised weakness, anorexia, and sudden unexplained weight loss, gastrointestinal symptoms and respiratory symptoms (dyspnoea and tachypnoea).

Caution should be exercised when administering TRIUMEQ particularly to those with known risk factors for liver disease. Treatment with TRIUMEQ should be suspended in any patient who develops clinical or laboratory findings suggestive of lactic acidosis with or without hepatitis (which may include hepatomegaly and steatosis even in the absence of marked transaminase elevations).

## **Lipodystrophy**

Redistribution/accumulation of body fat, including central obesity, dorsocervical fat enlargement (buffalo hump), peripheral wasting, facial wasting, breast enlargement, elevated serum lipid and blood glucose levels have been observed either separately or together in some patients receiving combination antiretroviral therapy (see *Adverse Effects*).

Whilst all members of the protease and nucleoside reverse transcriptase inhibitor classes of medicinal products have been associated with one or more of these specific adverse events, linked to a general syndrome commonly referred to as lipodystrophy, data indicate that there are differences in the risk between individual members of the respective therapeutic classes.

In addition, the lipodystrophy syndrome has a multi-factorial aetiology; with for example HIV disease status, older age and duration of antiretroviral treatment all playing important, possibly synergistic roles.

The long-term consequences of these events are currently unknown.

Clinical examination should include evaluation for physical signs of fat redistribution. Consideration should be given to the measurement of serum lipids and blood glucose. Lipid disorders should be managed as clinically appropriate.

## **Immune Reconstitution Syndrome**

In HIV-infected patients with severe immune deficiency at the time of initiation of anti-retroviral therapy (ART), an inflammatory reaction to asymptomatic or residual opportunistic infections may arise and cause serious clinical conditions, or aggravation of symptoms. Typically, such reactions have been observed within the first few weeks or months of initiation of ART. Relevant examples are cytomegalovirus retinitis, generalised and/or focal mycobacterial infections and *Pneumocystis jiroveci* (*P. carinii*) pneumonia. Any inflammatory symptoms must be evaluated without delay and treatment initiated when necessary. Autoimmune disorders (such as Graves' disease, polymyositis and Guillain-Barre syndrome) have also been reported to occur in the setting of immune reconstitution, however, the time to onset is more variable, and can occur many months after initiation of treatment and sometimes can be an atypical presentation.

Liver chemistry elevations consistent with immune reconstitution syndrome were observed in some hepatitis B and/or C co-infected patients at the start of dolutegravir therapy. Monitoring of liver chemistries is recommended in patients with hepatitis B and/or C co-infection (see *Patients co-infected with hepatitis B virus (HBV) later in this section and Adverse Effects*).

## **Patients Co-infected with Hepatitis B Virus (HBV)**

Particular diligence should be applied in initiating or maintaining effective hepatitis B therapy when starting therapy with TRIUMEQ in hepatitis B co-infected patients.

Clinical study and marketed use of lamivudine, have shown that some patients with chronic HBV disease may experience clinical or laboratory evidence of recurrent hepatitis upon discontinuation of lamivudine, which may have more severe consequences in patients with decompensated liver disease. If TRIUMEQ is discontinued in patients co-infected with HBV, periodic monitoring of both liver function tests and markers of HBV replication should be considered.

## **Opportunistic Infections**

Patients receiving TRIUMEQ or any other antiretroviral therapy may still develop opportunistic infections and other complications of HIV infection. Therefore patients should

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remain under close clinical observation by physicians experienced in the treatment of these associated HIV diseases.

### **Transmission of Infection**

Effective antiretroviral treatment substantially reduces but does not completely eliminate transmission of HIV to others through sexual contact or blood contamination. Appropriate precautions should continue to be taken.

### **Myocardial Infarction**

In a prospective, observational, epidemiological study designed to investigate the rate of myocardial infarction in patients on combination antiretroviral therapy, a total of 33,347 HIV-infected patients were followed for 157,912 person-years. The use of abacavir within the previous six months was correlated with a significantly increased risk of myocardial infarction (relative risk: 1.94, 95% CI: 1.48 – 2.55). In a pooled analysis of GSK sponsored clinical trials no excess risk of myocardial infarction was observed with abacavir use. There is no known biological mechanism to explain a potential increase. In totality the available data from observational cohorts and from controlled clinical trials are inconclusive in regard to the relationship between abacavir treatment and the risk of myocardial infarction.

As a precaution the underlying risk of coronary heart disease should be considered when prescribing antiretroviral therapies, including abacavir, and action taken to minimize all modifiable risk factors (e.g. hypertension, hyperlipidaemia, diabetes mellitus and smoking).

### **Patients with resistance to the integrase class (documented or clinically suspected)**

TRIUMEQ alone is not recommended in patients with resistance associated with integrase substitutions or clinically suspected integrase strand transfer inhibitor resistance because the dose of dolutegravir in TRIUMEQ is insufficient in these populations (see Dosage and Administration and TIVICAY [dolutegravir] Product Information).

### **Effects on Fertility:**

There are no data on the effects of dolutegravir, abacavir or lamivudine on human male or female fertility. No studies on the effect on fertility in animals have been conducted with the dolutegravir/abacavir/lamivudine combination. Individually, dolutegravir, abacavir and lamivudine did not affect male or female mating or fertility in rats at doses associated with exposure levels approximately 44, 30 or 64 (respectively) higher than the exposures in humans at doses of 50mg, 600mg, and 300mg (respectively).

### **Use in Pregnancy (Category B3):**

The safe use of TRIUMEQ in human pregnancy has not been established. Dolutegravir, abacavir and lamivudine were shown to cross the placenta in reproductive toxicity studies in animals. Lamivudine and abacavir were associated with adverse findings in animal reproductive toxicity studies (see below). Therefore administration of TRIUMEQ in pregnancy should be considered only if the benefit to the mother outweighs the possible risk to the foetus.

There have been reports of mild, transient elevations in serum lactate levels, which may be due to mitochondrial dysfunction, in neonates and infants exposed *in utero* or peri-partum to nucleoside reverse transcriptase inhibitors (NRTIs). The clinical relevance of transient elevations in serum lactate is unknown. There have also been very rare reports of developmental delay, seizures and other neurological disease. However, a causal relationship between these events and NRTI exposure *in utero* or peri-partum has not been established. These findings do not affect current recommendations to use antiretroviral therapy in pregnant women to prevent vertical transmission of HIV.



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Oral administration of dolutegravir to pregnant rats at doses up to 1000 mg/kg daily from days 6 to 17 of gestation did not elicit maternal toxicity, developmental toxicity or teratogenicity (50 times the 50 mg human clinical exposure when dolutegravir is administered in combination with abacavir and lamivudine, based on AUC).

Oral administration of dolutegravir to pregnant rabbits at doses up to 1000 mg/kg daily from days 6 to 18 of gestation was associated with marked maternal toxicity, but did not elicit developmental toxicity or teratogenicity (0.74 times the 50 mg human clinical exposure when dolutegravir is administered in combination with abacavir and lamivudine, based on AUC).

Studies in pregnant rats showed that abacavir is transferred to the fetus through the placenta. Developmental toxicity (depressed fetal body weight and reduced crown-rump length) and increased incidences of fetal anasarca and skeletal malformations were observed when rats were treated with abacavir at doses of 648 mg/kg during organogenesis (approximately 31 times the human therapeutic exposure based on AUC, for a 600 mg dose in combination with dolutegravir and lamivudine at the recommended dose). In a fertility study, evidence of toxicity to the developing embryo and fetuses (increased resorptions, decreased fetal body weights) occurred only at 427 mg/kg per day. The offspring of female rats treated with abacavir at 427 mg/kg (beginning at embryo implantation and ending at weaning) showed increased incidence of still birth and lower body weights throughout life. In the rabbit, there was no evidence of drug-related developmental toxicity and no increases in fetal malformations at doses up to 453 mg/kg (7 times the expected human exposure, based on AUC).

Lamivudine was not teratogenic in animal studies, but there were indications of an increase in early embryonic deaths in rabbits at exposure levels (based on  $C_{max}$  and AUC) comparable to or below those achieved in man. However, there was no evidence of embryonic loss in rats at exposure levels of approximately 32 times the clinical exposure (based on  $C_{max}$ ).

Mitochondrial dysfunction: nucleoside and nucleotide analogues have been demonstrated in vitro and in vivo to cause a variable degree of mitochondrial damage. There have been reports of mitochondrial dysfunction in HIV-negative infants exposed in utero and/or post-natally to nucleoside analogues. The main adverse reactions reported are haematological disorders (anaemia, neutropenia), metabolic disorders (hyperlactatemia, hyperlipasemia). These reactions are often transitory. Some late-onset neurological disorders have been reported (hypertonia, convulsion, abnormal behaviour). Whether the neurological disorders are transient or permanent is currently unknown. Any child exposed in utero to nucleoside and nucleotide analogues, even HIV negative children, should have clinical and laboratory follow-up and should be fully investigated for possible mitochondrial dysfunction in case of relevant signs or symptoms. These findings do not affect current national recommendations to use antiretroviral therapy in pregnant women to prevent vertical transmission of HIV.

### **Use in Lactation**

Health experts recommend that where possible HIV infected women do not breast-feed their infants in order to avoid transmission of HIV. In settings where formula feeding is not feasible, local official lactation and treatment guidelines should be followed when considering breast feeding during antiretroviral therapy.

It is expected that dolutegravir will be secreted into human milk based on animal data, although this has not been confirmed in humans.

In a study following repeat oral dose of either 150 mg lamivudine twice daily (given in combination with 300 mg zidovudine twice daily) or 300 mg lamivudine twice daily,

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lamivudine was excreted in human breast milk (0.5 to 8.2 µg/ml) at similar concentrations to those found in serum. In other studies following repeat oral dose of 150 mg lamivudine twice daily (given either in combination with 300 mg zidovudine or as COMBIVIR or TRIZIVIR) the breast milk: maternal plasma ratio ranged between 0.6 and 3.3. In a study after repeat oral administration of 300 mg abacavir twice daily (given as Trizivir), the breast milk: maternal plasma ratio was 0.9. No pharmacokinetic studies were conducted with abacavir once daily oral administration. Lamivudine median infant serum concentrations ranged between 18 and 28 ng/mL and were not detectable in one of the studies (assay sensitivity 7 ng/mL). Most infants (8 out of 9) had non-detectable levels of abacavir (assay sensitivity 16 ng/mL). Intracellular carbovir and lamivudine triphosphate (active metabolites of abacavir and lamivudine) levels in breastfed infants were not measured therefore the clinical relevance of the serum concentrations of the parent compounds measured is unknown.

### **Paediatric Use**

TRIUMEQ is not recommended for treatment of children less than 12 years of age as the necessary dose adjustment cannot be made. Clinical data is currently not available for this combination. Physicians should refer to the individual product information for TIVICAY [dolutegravir], ZIAGEN [abacavir] and 3TC [lamivudine].

### **Use in the Elderly**

There are limited data available on the use of dolutegravir, abacavir and lamivudine in patients aged 65 years and over. However, there is no evidence that elderly patients require a different dose than younger adult patients (*see Pharmacokinetics – Special Patient Populations*). When treating elderly patients, consideration needs to be given to the greater frequency of decreased hepatic, renal and cardiac function, concomitant medicinal products or disease.

### **Effects on Ability to Drive and Use Machines**

There have been no studies to investigate the effect of dolutegravir, abacavir or lamivudine, on driving performance or the ability to operate machinery. A detrimental effect on such activities would not be anticipated given the pharmacology of these medicinal products. The clinical status of the patient and the adverse event profile of TRIUMEQ should be borne in mind when considering the patient's ability to drive or operate machinery.

### **Genotoxicity**

No genotoxicity studies have been conducted with the combination of dolutegravir, abacavir and lamivudine.

Dolutegravir was not mutagenic or clastogenic using *in vitro* tests in bacteria and cultured mammalian cells, and an *in vivo* rodent micronucleus assay.

Neither abacavir nor lamivudine were mutagenic in bacterial tests, but both induced mutations in a mouse lymphoma assay and were clastogenic in human peripheral lymphocytes *in vitro*. In rats, lamivudine did not cause chromosomal damage in bone marrow cells *in vivo* or cause DNA damage in primary hepatocytes. Abacavir was clastogenic in an *in vivo* micronucleus assay in mice, but not in rats when tested in combination with lamivudine at systemic exposures corresponding to 86 and 31 times the clinical exposure level for ABC and 3TC, respectively.

### **Carcinogenicity**

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No carcinogenicity studies have been conducted with the combination of dolutegravir, abacavir and lamivudine.

Dolutegravir was not carcinogenic in long term studies in the mouse and rat (respectively, 27 and 23 times the 50 mg human clinical exposure when dolutegravir is administered in combination with abacavir and lamivudine, based on AUC).

Carcinogenicity studies with orally administered abacavir in mice and rats showed an increase in the incidence of malignant and non-malignant tumours. Malignant tumours occurred in the preputial gland of males and the clitoral gland of females of both species, and in the liver, urinary bladder, lymph nodes and the subcutis of female rats. Nonmalignant tumours occurred in the liver of mice and rats, Harderian gland of female mice, and thyroid gland of rats. In rats, there were also increased incidences of urothelial hyperplasia and urinary bladder tumours, associated with increased urinary calculi.

The majority of these tumours occurred at the highest abacavir dose of 330 mg/kg/day in mice and 600 mg/kg/day in rats. These dose levels were equivalent to 21 to 30 times the expected systemic exposure in humans when abacavir is administered in combination with dolutegravir and lamivudine. The exception was preputial gland tumours in mice which occurred at a dose of 110 mg/kg. Exposure at this dose is approximately 5 times the expected human systemic exposure. The carcinogenic potential in humans is unknown.

When lamivudine was administered orally to separate groups of rodents at doses up to 2000 times (mice and male rats) and 3000 (female rats) mg/kg/day, there was no evidence of a carcinogenic effect due to lamivudine in the mouse study. In the rat study there was an increased incidence of endometrial tumours at the highest dose (approximately 70 times the estimated human exposure at the recommended therapeutic dose of one tablet twice daily, based on AUC). However, the relationship of this increase to treatment is uncertain.

### **Animal Toxicology**

The effect of prolonged daily treatment with high doses of dolutegravir has been evaluated in repeat oral dose toxicity studies in rats (up to 26 weeks) and in monkeys (up to 38 weeks). The primary effect of dolutegravir was gastrointestinal intolerance or irritation in rats and monkeys at doses that produce systemic exposures approximately 38 and 1.5 times the 50 mg human clinical exposure when dolutegravir is administered in combination with abacavir and lamivudine, based on AUC, respectively. Because gastrointestinal (GI) intolerance is considered to be due to local drug administration, mg/kg or mg/m<sup>2</sup> metrics are appropriate determinates of safety cover for this toxicity. GI intolerance in monkeys occurred at 30 times the human mg/kg equivalent dose (based on 50 kg human), and 11 times the human mg/m<sup>2</sup> equivalent dose for a total daily clinical dose of 50 mg.

Mild myocardial degeneration in the heart of mice and rats was observed following administration of abacavir for two years. The systemic exposures were equivalent to 7 to 19 times human exposure at 600 mg when abacavir is administered in combination with dolutegravir and lamivudine. The clinical relevance of this finding has not been determined.

### **INTERACTIONS WITH OTHER MEDICINES**

Caution should be given to co-administering medications (prescription and non-prescription) that may change the exposure of dolutegravir, abacavir, lamivudine or medications that may have their exposure changed by TRIUMEQ.

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The co-administration of dolutegravir with etravirine (ETR) is not recommended unless the patient is also receiving concomitant atazanavir + ritonavir (ATV+RTV), lopinavir + ritonavir (LPV+RTV) or darunavir + ritonavir (DRV+RTV).

Dolutegravir should not be co-administered with polyvalent cation-containing antacids. Dolutegravir is recommended to be administered 2 hours before or 6 hours after these agents.

TRIUMEQ is recommended to be administered 2 hours before or 6 hours after taking calcium or iron supplements, or alternatively, administered with food.

Metformin concentrations may be increased by TRIUMEQ. Lower metformin doses may be considered for patients treated with dolutegravir and metformin.

TRIUMEQ should not be administered concurrently with other medicinal products containing any of the same active components (dolutegravir, abacavir, and/or lamivudine).

Since the recommended dose of dolutegravir is 50 mg twice daily for patients taking efavirenz, nevirapine, rifampicin and tipranavir/ritonavir, the use of TRIUMEQ is not recommended for patients taking these medicines.

As TRIUMEQ contains dolutegravir, abacavir and lamivudine, any interactions that have been identified with these agents individually may occur with TRIUMEQ. Due to the different routes of metabolism and elimination, no clinically significant drug interactions are expected between dolutegravir, abacavir and lamivudine. In a cross study comparison, abacavir and lamivudine exposures were similar when given as TRIUMEQ compared to ABC/3TC alone.

#### **Effect of TRIUMEQ on the Pharmacokinetics of Other Agents**

*In vitro*, dolutegravir inhibited the basolateral renal transporters: organic anion transporter (OAT) 1 (IC<sub>50</sub> = 2.12 nM) and OAT3 (IC<sub>50</sub> = 1.97 nM). However, dolutegravir had no notable effect on the pharmacokinetics *in vivo* of the OAT substrates tenofovir and para aminohippurate, and therefore has low propensity to cause drug interactions via inhibition of OAT transporters.

*In vitro*, dolutegravir inhibited the renal organic cation transporter 2 (OCT2) (IC<sub>50</sub> = 1.93 μM), multidrug and toxin extrusion transporter (MATE) 1 (IC<sub>50</sub> = 6.34 nM) and MATE2-K (IC<sub>50</sub> = 24.8 nM). *In vivo*, dolutegravir may increase plasma concentrations of drugs in which excretion is dependent upon OCT2 or MATE1 (dofetilide or metformin) (see Table 3). Given dolutegravir's *in vivo* exposure, it has a low potential to affect the transport of MATE2-K substrates *in vivo*.

*In vitro*, dolutegravir demonstrated no direct, or weak inhibition (IC<sub>50</sub>>50 μM) of the enzymes cytochrome P450 (CYP)1A2, CYP2A6, CYP2B6, CYP2C8, CYP2C9, CYP2C19, CYP2D6 CYP3A, uridine diphosphate glucuronosyl transferase (UGT)1A1 or UGT2B7, or the transporters Pgp, BCRP, BSEP, OATP1B1, OATP1B3, OCT1 MRP2, or MRP4. *In vitro*, dolutegravir did not induce CYP1A2, CYP2B6 or CYP3A4. Based on these data, dolutegravir is not expected to affect the pharmacokinetics of drugs that are substrates of these enzymes or transporters.

In drug interaction studies, dolutegravir did not have a clinically relevant effect on the pharmacokinetics of the following: tenofovir, methadone, efavirenz, lopinavir, atazanavir, darunavir, etravirine, fosamprenavir, and oral contraceptives containing norelgestromin and ethinyl estradiol.

Abacavir and lamivudine are not significantly metabolised by cytochrome P450 enzymes (such as CYP 3A4, CYP 2C9 or CYP 2D6) nor do they inhibit or induce this enzyme

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system. Therefore, there is little potential for interactions with other medicinal products metabolised by major P450 enzymes.

### **Effect of Other Agents on the Pharmacokinetics of TRIUMEQ**

Dolutegravir is eliminated mainly through metabolism by UGT1A1. Dolutegravir is also a substrate of UGT1A3, UGT1A9, CYP3A4, Pgp, and BCRP; therefore drugs that induce these enzymes or transporters may theoretically decrease dolutegravir plasma concentration and reduce the therapeutic effect of dolutegravir. Co-administration of dolutegravir and other drugs that inhibit UGT1A1, UGT1A3, UGT1A9, CYP3A4, and/or PGP may increase dolutegravir plasma concentration (see Table 3).

Efavirenz, nevirapine, rifampicin and tipranavir/ritonavir each reduced the plasma concentrations of dolutegravir significantly, and require dolutegravir dose adjustment to 50 mg twice daily. Etravirine also reduced plasma concentrations, but the effect of etravirine was mitigated by co-administration of the CYP3A4 inhibitors lopinavir/ritonavir, darunavir/ritonavir, and is expected to be mitigated by atazanavir/ritonavir. Therefore no dolutegravir dose adjustment is necessary when co-administered with etravirine and either lopinavir/ritonavir, darunavir/ritonavir, or atazanavir/ritonavir. Another inducer, fosamprenavir in combination with ritonavir decreased plasma concentrations of dolutegravir but does not require a dosage adjustment of dolutegravir. A drug interaction study with the UGT1A1 inhibitor, atazanavir, did not result in a clinically meaningful increase in the plasma concentrations of dolutegravir. Tenofovir, ritonavir, lopinavir/ritonavir and darunavir/ritonavir had no or a minimal effect on dolutegravir pharmacokinetics, therefore no dolutegravir dose adjustment is required when co-administered with these drugs.

The likelihood of metabolic interactions with abacavir and lamivudine is low. Abacavir and lamivudine are not significantly metabolised by CYP enzymes. The primary pathways of abacavir metabolism in human are by alcohol dehydrogenase and by glucuronidation to produce the 5'-carboxylic acid and 5'-glucuronide which account for about 66% of the administered dose. These metabolites are excreted in the urine.

The likelihood of metabolic interactions with lamivudine is low due to limited metabolism and plasma protein binding, and almost complete renal clearance. Lamivudine is predominantly eliminated by active organic cationic secretion. The possibility of interactions with other medicinal products administered concurrently should be considered, particularly when the main route of elimination is renal.

TRIUMEQ is a fixed-dose tablet and should not be prescribed for patients requiring dosage adjustments due to interacting concomitant medications. Separate preparations of dolutegravir (TIVICAY), abacavir (ZIAGEN) or lamivudine (3TC) should be administered in cases where dose adjustment is required. In these cases the physician should refer to the individual product information for these medicinal products.

Selected drug interactions are presented in Tables 3, 4 and 5. Recommendations are based on either drug interaction studies or predicted interactions due to the expected magnitude of interaction and potential for serious adverse events or loss of efficacy.

**Table 3 Drug Interactions studied with dolutegravir**

<b>Concomitant Drug Class: Drug Name</b>	<b>Effect on Concentration of Dolutegravir or Concomitant Drug</b>	<b>Clinical Comment</b>
<b>HIV-1 Antiviral Agents</b>		
Non-nucleoside	Dolutegravir <sup>-</sup>	Etravirine decreased plasma

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Reverse Transcriptase Inhibitor: Etravirine (ETR)	AUC - 71% C <sub>max</sub> - 52% Ct - 88% ETR «	dolutegravir concentration, which may result in loss of virologic response and possible resistance to dolutegravir. TRIUMEQ should not be used with etravirine without co-administration of atazanavir/ritonavir, darunavir/ritonavir or lopinavir/ritonavir.
Non-nucleoside Reverse Transcriptase Inhibitor: Efavirenz (EFV)	Dolutegravir - AUC - 57% C <sub>max</sub> - 39% Ct - 75% EFV «	Efavirenz decreased dolutegravir plasma concentrations. Since the dose of dolutegravir is 50 mg twice daily when co-administered with efavirenz the co-administration of efavirenz with TRIUMEQ is not recommended.
Non-nucleoside Reverse Transcriptase Inhibitor: Nevirapine	Dolutegravir -	Co-administration with nevirapine has the potential to decrease dolutegravir plasma concentration due to enzyme induction and has not been studied. Effect of nevirapine on dolutegravir exposure is likely similar to or less than that of efavirenz. Since the dose of dolutegravir is 50 mg twice daily when co-administered with nevirapine, the co-administration of nevirapine with TRIUMEQ is not recommended.
Protease Inhibitor: Atazanavir (ATV)	Dolutegravir - AUC - 91% C <sub>max</sub> - 49% Ct - 180% ATV «	Atazanavir increased dolutegravir plasma concentration. No dose adjustment is necessary.
Protease Inhibitor: Atazanavir/ritonavir (ATV+RTV)	Dolutegravir - AUC - 62% C <sub>max</sub> - 33% Ct - 121% ATV « RTV «	Atazanavir/ritonavir increased dolutegravir plasma concentration. No dose adjustment is necessary.
Protease Inhibitor: Tipranavir/ritonavir (TPV+RTV)	Dolutegravir - AUC - 59% C <sub>max</sub> - 47% Ct - 76% TPV « RTV «	Tipranavir/ritonavir decreases dolutegravir concentrations. Since the dose of dolutegravir is 50 mg twice daily when co-administered with tipranavir/ritonavir, the co-administration of tipranavir/ritonavir with TRIUMEQ is not recommended.
Protease Inhibitor: Fosamprenavir/ritonavir (FPV+RTV)	Dolutegravir - AUC - 35% C <sub>max</sub> - 24% Ct - 49% FPV «	Fosamprenavir/ritonavir decreases dolutegravir concentrations, but based on limited data, did not result in decreased efficacy in Phase III studies. No dose adjustment is necessary in INI-naïve patients.

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	RTV «	
Protease Inhibitor: Nelfinavir	Dolutegravir «	This interaction has not been studied. Although an inhibitor of CYP3A4, based on data from other inhibitors, an increase is not expected. No dose adjustment is necessary.
Protease Inhibitor: Darunavir/ritonavir (DRV+RTV)	Dolutegravir <sup>-</sup> AUC <sup>-</sup> 32% C <sub>max</sub> <sup>-</sup> 11% Ct <sup>-</sup> 38%	Darunavir/ritonavir did not change dolutegravir plasma concentration to a clinically relevant extent. No dose adjustment is necessary.
Nucleoside Reverse Transcriptase Inhibitor: Tenofovir (TDF)	Dolutegravir «	Tenofovir did not change dolutegravir plasma concentration to a clinically relevant extent. No dose adjustment is necessary.
Protease Inhibitor: Lopinavir/ritonavir + Etravirine (LPV/RTV+ETR)	Dolutegravir « AUC - 10% C <sub>max</sub> - 7% Ct - 28% LPV « RTV «	Lopinavir/ritonavir and etravirine did not change dolutegravir plasma concentration to a clinically relevant extent. No dose adjustment is necessary.
Protease Inhibitor: Darunavir/ritonavir + Etravirine (DRV/RTV+ETR)	Dolutegravir <sup>-</sup> AUC <sup>-</sup> 25% C <sub>max</sub> <sup>-</sup> 12% Ct <sup>-</sup> 36% DRV « RTV «	Darunavir/ritonavir and etravirine did not change dolutegravir plasma concentration to a clinically relevant extent. No dose adjustment is necessary.
<b>Other Agents</b>		
Dofetilide Pilsicainide	Dofetilide - Pilsicainide-	Co-administration of dolutegravir has the potential to increase dofetilide or pilsicainide plasma concentration via inhibition of OCT2 transporter; co-administration has not been studied. Dofetilide or pilsicainide co-administration with dolutegravir is contraindicated due to potential life-threatening toxicity caused by high dofetilide or pilsicainide concentration.
Oxcarbazepine Phenytoin Phenobarbital Carbamazepine St. John's wort	Dolutegravir <sup>-</sup>	Co-administration with these metabolic inducers may decrease dolutegravir plasma concentration and has not been studied. Co-administration with these metabolic inducers should be avoided.
Antacids containing polyvalent cations (e.g., Mg, Al)	Dolutegravir <sup>-</sup> AUC <sup>-</sup> 74% C <sub>max</sub> <sup>-</sup> 72% C <sub>24</sub> <sup>-</sup> 74%	Co-administration of antacids containing polyvalent cations decreased dolutegravir plasma concentration. Dolutegravir is recommended to be administered 2 hours before or 6 hours after taking

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		antacid products containing polyvalent cations.
Calcium supplements	Dolutegravir <sup>-</sup> AUC <sup>-</sup> 39% C <sub>max</sub> <sup>-</sup> 37% C <sub>24</sub> <sup>-</sup> 39%	TRIUMEQ is recommended to be administered 2 hours before or 6 hours after taking products containing calcium, or alternatively, administer with food.
Iron supplements	Dolutegravir <sup>-</sup> AUC <sup>-</sup> 54% C <sub>max</sub> <sup>-</sup> 57% C <sub>24</sub> <sup>-</sup> 56%	TRIUMEQ is recommended to be administered 2 hours before or 6 hours after taking products containing iron, or alternatively, administer with food.
Metformin	Metformin -	Co-administration of dolutegravir has the potential to increase metformin plasma concentration via inhibition of OCT2 transporter; co-administration has not been studied. Lower metformin doses may be considered for patients treated with dolutegravir and metformin.
Rifampicin	Dolutegravir <sup>-</sup> AUC <sup>-</sup> 54% C <sub>max</sub> <sup>-</sup> 43% C <sub>t</sub> <sup>-</sup> 72%	Rifampicin decreased dolutegravir plasma concentration. Since the dose of dolutegravir is 50 mg twice daily when co-administered with rifampicin, the co-administration of rifampicin with TRIUMEQ is not recommended.
Oral contraceptives (Ethinyl estradiol (EE) and Norelgestromin (NGMN))	Effect of dolutegravir: EE « AUC - 3% C <sub>max</sub> <sup>-</sup> 1% C <sub>t</sub> - 2% Effect of dolutegravir: NGMN « AUC <sup>-</sup> 2% C <sub>max</sub> <sup>-</sup> 11% C <sub>t</sub> <sup>-</sup> 7%	Dolutegravir did not change ethinyl estradiol and norelgestromin plasma concentrations to a clinically relevant extent. No dose adjustment of oral contraceptives is necessary when co-administered with dolutegravir.
Methadone	Effect of dolutegravir: Methadone « AUC <sup>-</sup> 2% C <sub>max</sub> <sup>«</sup> 0% C <sub>t</sub> <sup>-</sup> 1%	Dolutegravir did not change methadone plasma concentrations to a clinically relevant extent. No dose adjustment of methadone is necessary when co-administered with dolutegravir.

Abbreviations: - = Increase; <sup>-</sup> = decrease; « = no significant change; AUC = area under the concentration versus time curve; C<sub>max</sub> = maximum observed concentration, C<sub>t</sub>=concentration at the end of dosing interval

**Table 4 Drug Interactions studied with abacavir**

<b>Concomitant Drug Class: Drug Name</b>	<b>Effect on Concentration of abacavir or Concomitant Drug</b>	<b>Clinical Comment</b>
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Methadone (40 to 90mg once daily for 14 days/600mg single dose, then 600mg twice daily for 14 days)	Abacavir AUC « C <sub>max</sub> <sup>-</sup> 35% Methadone CL/F - 22%	The changes in abacavir pharmacokinetics are not considered clinically relevant. The changes in methadone pharmacokinetics are not considered clinically relevant for the majority of patients, however occasionally methadone dose re-titration may be required.
Ethanol	Abacavir AUC - 41% Ethanol AUC «	Given the safety profile of abacavir, these findings are not considered clinically significant.

Abbreviations: - = Increase; <sup>-</sup> = decrease; « = no significant change; AUC = area under the concentration versus time curve; C<sub>max</sub> = maximum observed concentration, CL/F = apparent clearance

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**Table 5 Drug Interactions studied with lamivudine**

<b>Concomitant Drug Class: Drug Name</b>	<b>Effect on Concentration of lamivudine or Concomitant Drug</b>	<b>Clinical Comment</b>
Trimethoprim/sulfamethoxazole (Co-trimoxazole) (160mg/800mg once daily for 5 days/300mg single dose)	Lamivudine: AUC - 40% Trimethoprim: AUC « Sulfamethoxazole: AUC «	Unless the patient has renal impairment, no dosage adjustment of lamivudine is necessary (see Dosage and Administration). Lamivudine has no effect on the pharmacokinetics of trimethoprim or sulfamethoxazole. The effect of co-administration of lamivudine with higher doses of co-trimoxazole used for the treatment of <i>Pneumocystis jirovecii</i> ( <i>P. carinii</i> ) pneumonia and toxoplasmosis has not been studied. TRIUMEQ is not recommended for patients with CrCl of <50 ml/min.
Emtricitabine		Lamivudine may inhibit the intracellular phosphorylation of emtricitabine when the two medicinal products are used concurrently. Additionally, the mechanism of viral resistance for both lamivudine and emtricitabine is mediated via mutation of the same viral reverse transcriptase gene (M184V) and therefore the therapeutic efficacy of these drugs in combination therapy may be limited. Lamivudine is not recommended for use in combination with emtricitabine or emtricitabine-containing fixed-dose combinations.
Zalcitabine		Lamivudine may inhibit the intracellular phosphorylation of zalcitabine when the two medicinal products are used concurrently. TRIUMEQ is therefore not recommended to be used in combination with zalcitabine.

Abbreviations: - = Increase; « = no significant change; AUC = area under the concentration versus time curve

## **ADVERSE EFFECTS**

TRIUMEQ contains dolutegravir, abacavir and lamivudine, therefore the adverse events associated with these may be expected. For many of the adverse events listed it is unclear whether they are related to the active substance, the wide range of other medicinal products used in the management of HIV infection, or whether they are a result of the underlying disease process.

**Hypersensitivity to Abacavir** (see also *Precautions*).

Overall, in clinical studies conducted before the introduction of screening for the HLA-B\*5701 allele, approximately 5% of patients receiving abacavir developed a hypersensitivity reaction, which in rare cases has proved fatal. This reaction is characterised by the appearance of symptoms indicating multi-organ/body-system involvement.

Almost all patients developing hypersensitivity reactions will have fever and/or rash (usually maculopapular or urticarial) as part of the syndrome, however reactions have occurred without rash or fever.

Symptoms can occur at any time while being treated with abacavir, but usually appear within the first six weeks of initiation of treatment (median time to onset 11 days).

The signs and symptoms of this hypersensitivity reaction are listed below. Those reported **in at least 10%** of patients with a hypersensitivity reaction are in bold text.

<i>Skin:</i>	<b>rash</b> (usually maculopapular or urticarial)
<i>Gastrointestinal tract:</i>	<b>nausea, vomiting, diarrhoea, abdominal pain</b> , mouth ulceration
<i>Respiratory tract:</i>	<b>dyspnoea, cough</b> , sore throat, adult respiratory distress syndrome, respiratory failure
<i>Miscellaneous:</i>	<b>fever, fatigue, malaise</b> , oedema, lymphadenopathy, hypotension, conjunctivitis, anaphylaxis
<i>Neurological/Psychiatry:</i>	<b>headache</b> , paraesthesia
<i>Haematological:</i>	Lymphopenia
<i>Liver/pancreas:</i>	<b>elevated liver function tests</b> , hepatic failure
<i>Musculoskeletal:</i>	<b>myalgia</b> , rarely myolysis, arthralgia, elevated creatine phosphokinase
<i>Urology:</i>	elevated creatinine, renal failure

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Some patients with hypersensitivity were initially thought to have respiratory disease (pneumonia, bronchitis, pharyngitis), a flu-like illness, gastroenteritis or reactions to other medications. This delay in diagnosis of hypersensitivity has resulted in abacavir being continued or re-introduced, leading to a more severe hypersensitivity reaction or death. Therefore, the diagnosis of hypersensitivity reaction should be carefully considered for patients presenting with symptoms of these diseases. If hypersensitivity reaction cannot be ruled out, TRIUMEQ, or any other medicinal product containing abacavir (e.g. ZIAGEN [abacavir], KIVEXA [abacavir/lamivudine], TRIZIVIR [abacavir/lamivudine/zidovudine]) should not be restarted.

The symptoms related to this hypersensitivity reaction worsen with continued therapy, and usually resolve upon discontinuation of abacavir.

Restarting abacavir following a hypersensitivity reaction results in a prompt return of symptoms within hours. **This recurrence of the hypersensitivity reaction may be more severe than on initial presentation, and may include life-threatening hypotension and death. Regardless of their HLA-B\*5701 status, patients who develop this hypersensitivity reaction must discontinue TRIUMEQ and must never be rechallenged with TRIUMEQ, or any other medicinal product containing abacavir (e.g. ZIAGEN [abacavir], KIVEXA [abacavir/lamivudine], TRIZIVIR [abacavir/lamivudine/zidovudine]).**

There have been infrequent reports of hypersensitivity reactions following reintroduction of abacavir, where the interruption was preceded by a single key symptom of hypersensitivity (rash, fever, malaise/fatigue, gastrointestinal or a respiratory symptom).

On very rare occasions hypersensitivity reactions have been reported in patients who have restarted therapy, and who had no preceding symptoms of a hypersensitivity reaction.

Many of the adverse events listed occur commonly (nausea, vomiting, diarrhoea, fever, lethargy, rash) in patients with abacavir hypersensitivity. Therefore, patients with any of these symptoms should be carefully evaluated for the presence of this hypersensitivity reaction. If TRIUMEQ has been discontinued in patients due to experiencing any one of these symptoms and a decision is made to restart abacavir, this must be done only under direct medical supervision (see *Special considerations following an interruption of TRIUMEQ therapy in Precautions*).

Adverse drug reactions for dolutegravir, abacavir or lamivudine are listed in the tables below by MedDRA system organ class and by frequency. Frequencies are defined as very common ( $\geq 1/10$ ), common ( $\geq 1/100$ ,  $< 1/10$ ), uncommon ( $\geq 1/1,000$ ,  $< 1/100$ ), rare ( $\geq 1/10,000$ ,  $< 1/1000$ ) and very rare ( $< 1/10,000$ ), including isolated reports.

### **Clinical Trial Data**

Clinical safety data with TRIUMEQ are limited. The adverse reactions observed for the combination of DTG + ABC/3TC in analysis of pooled data from Phase IIb to Phase IIIb clinical trials were generally consistent with the adverse reaction profiles for the individual components dolutegravir, abacavir and lamivudine.

There was no difference between the combination and the individual components in severity for any observed adverse reactions.

### ***Treatment Naïve Patients***

The safety assessment of TRIUMEQ is primarily based on the analyses of 48 and 96 week data from a randomized, international, multicentre, double-blind, active-controlled trial, SINGLE (ING114467) and supported by data in treatment-naïve patients from SPRING-2 (ING113086) and FLAMINGO (ING114915).

In SINGLE (ING114467), 833 patients were randomized and received at least 1 dose of either dolutegravir 50 mg with fixed-dose abacavir sulfate and lamivudine once daily (n = 414) or fixed-dose efavirenz-emtricitabine-tenofovir (EFV/TDF/FTC) once daily (n = 419). Through 96 weeks, the rate of adverse events leading to discontinuation was 3% in patients receiving dolutegravir + ABC/3TC and 12% in patients receiving EFV/TDF/FTC once daily.

In SPRING-2 (ING113086), 411 patients received dolutegravir once daily versus 411 who received raltegravir 400 mg twice daily, both in combination with investigator-selected nucleoside reverse transcriptase inhibitor (NRTI) background regimen (either ABC/3TC or TDF/FTC). Of these patients, 169 in the group receiving dolutegravir and 164 in the group receiving raltegravir were receiving KIVEXA [abacavir/lamivudine] as the background regimen. Through 96 weeks, the rate of adverse events leading to discontinuation in these patients was 3% in patients receiving dolutegravir and 2% in patients receiving raltegravir.

In FLAMINGO (ING114915), 243 patients received dolutegravir once daily versus 242 patients who received darunavir 800 mg/ritonavir 100 mg once daily, both in combination with investigator-selected NRTI background regimen (either ABC/3TC or TDF/FTC). There were 484 patients included in the efficacy and safety analyses. Of these patients, 79 in the group receiving dolutegravir and 80 in the group receiving darunavir were receiving ABC/3TC as the background regimen. Through 48 weeks, the rate of adverse events leading to discontinuation in these patients were 4% in patients receiving dolutegravir and 4% in patients receiving darunavir.

Treatment-emergent adverse reactions of moderate to severe intensity observed in <sup>3</sup>2% of patients in either treatment arm of SINGLE are provided in Table 6.

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**Table 6 Treatment-Emergent Adverse Reactions of at Least Moderate Intensity (Grades 2 to 4) and <sup>3</sup>2% Frequency in Treatment Naïve Patients in SINGLE (ING114467)**

Body System/ Preferred Term	48-Week		96-Week	
	DTG + ABC/3TC Once Daily (N = 414)	EFV/TDF/FTC Once Daily (N = 419)	DTG + ABC/3TC Once Daily (N = 414)	EFV/TDF/FTC Once Daily (N = 419)
<b>Psychiatric</b>				
Insomnia	3%	2%	3%	2%
Depression	<1%	1%	1%	2%
Abnormal dreams	<1%	2%	<1%	2%
<b>Nervous System</b>				
Dizziness	<1%	5%	<1%	5%
Headache	2%	2%	2%	2%
<b>Gastrointestinal</b>				
Nausea	<1%	3%	<1%	3%
Diarrhea	<1%	2%	<1%	2%
<b>General Disorders</b>				
Fatigue	1%	1%	2%	2%
<b>Skin and Subcutaneous Tissue</b>				
Rash	<1%	3%	<1%	3%
<b>Ear and Labyrinth</b>				
Vertigo	0	2%	0	2%

N = Number of patients in each treatment group; EFV/TDF/FTC = efavirenz 600 mg, tenofovir 300 mg, emtricitabine 200 mg

The adverse reactions observed in the subset of patients who received dolutegravir + ABC/3TC in SPRING-2 and FLAMINGO were generally consistent with those seen for the overall patient population participating in these trials.

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

In SAILING, 719 patients were randomized and received either dolutegravir once daily (n = 357) or raltegravir 400 mg twice daily (n = 362) with investigator-selected background regimen consisting of up to 2 agents, including at least one fully active agent. There were 715 patients included in the efficacy and safety analyses. At 48 weeks, the rate of adverse events leading to discontinuation was consistent with that seen in the overall treatment naïve patient population.

#### **Less Common Adverse Reactions Observed in Clinical Trials**

The following adverse reactions occurred in  $\leq 2\%$  of treatment naïve or treatment experienced patients in any one trial. These events have been included because of their seriousness and/or assessment of potential causal relationship.

*Gastrointestinal Disorders:* Abdominal pain, abdominal distention, abdominal discomfort, dyspepsia, flatulence, gastroesophageal reflux disease, upper abdominal pain, vomiting.

*General Disorders:* Fever, lethargy.

*Hepatobiliary Disorders:* Hepatitis.

*Immune System Disorders:* Hypersensitivity, immune reconstitution syndrome.

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*Metabolism and Nutrition Disorders:* Anorexia, hypertriglyceridemia.

*Musculoskeletal Disorders:* Arthralgia.

*Nervous:* Somnolence.

*Psychiatric:* Nightmare and sleep disorder

*Skin and Subcutaneous Tissue Disorders:* Pruritus.

**Laboratory Abnormalities: Treatment Naïve Subjects**

Selected laboratory abnormalities (Grades 2 to 4) with a worsening grade from baseline and representing the worst-grade toxicity in <sup>3</sup>2% of subjects in SINGLE are presented in Table 7. The mean change from baseline observed for selected lipid values is presented in Table 8.

**Table 7 Selected Laboratory Abnormalities (Grades 2 to 4) in Treatment Naïve Patients in SINGLE (ING114467)**

Laboratory Parameter Preferred Term	48 Week		96 Week	
	DTG + ABC/3TC Once Daily (N = 414)	EFV/TDF/FTC Once Daily (N = 419)	DTG + ABC/3TC Once Daily (N = 414)	EFV/TDF/FTC Once Daily (N = 419)
ALT				
Grade 2 (>2.5-5.0 x ULN)	2%	5%	2%	5%
Grade 3 to 4 (>5.0 x ULN)	<1%	<1%	<1%	<1%
AST				
Grade 2 (>2.5-5.0 x ULN)	2%	3%	3%	3%
Grade 3 to 4 (>5.0 x ULN)	0	2%	<1%	3%
Creatine kinase				
Grade 2 (6.0-9.9 x ULN)	4%	2%	4%	2%
Grade 3 to 4 ( $\geq$ 10.0 x ULN)	3%	5%	5%	7%
Hyperglycemia				
Grade 2 (6.95–13.88 mmol/L)	7%	5%	7%	5%
Grade 3 to 4 (>13.88 mmol/L)	1%	<1%	2%	<1%
Lipase				
Grade 2 (>1.5-3.0 x ULN)	8%	7%	9%	10%
Grade 3 to 4 (>3.0 ULN)	3%	2%	4%	3%
Total neutrophils				
Grade 2 ( $0.75-0.99 \times 10^9$ )	2%	4%	3%	5%
Grade 3 to 4 ( $<0.75 \times 10^9$ )	2%	3%	2%	3%

ULN = Upper limit of normal; N = Number of patients in each treatment group; EFV/TDF/FTC = efavirenz 600 mg, tenofovir 300 mg, emtricitabine 200 mg

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**Table 8. Mean Change From Baseline in Fasted Lipid Values in Treatment Naïve Subjects in SINGLE (ING114467)**

Laboratory Parameter Preferred Term	48 Week		96 Week	
	DTG + ABC/3TC Once Daily (N = 414)	EFV/TDF/FTC Once Daily (N = 419)	DTG + ABC/3TC Once Daily (N = 414)	EFV/TDF/FTC Once Daily (N = 419)
Cholesterol (mmol/L)	0.441	0.622	0.615	0.724
HDL cholesterol (mmol/L)	0.135	0.206	0.138	0.194
LDL cholesterol (mmol/L)	0.219	0.339	0.384	0.465
Triglycerides (mmol/L)	0.200	0.210	0.200	0.195

N = Number of patients in each treatment group; EFV/TDF/FTC = efavirenz 600 mg, tenofovir 300 mg, emtricitabine 200 mg

The rates of laboratory abnormalities and mean change in fasted lipid values remained generally similar between the 48 and 96 week data evaluation in SINGLE.

Laboratory abnormalities observed in the subset of subjects who received dolutegravir + ABC/3TC in SPRING-2 and FLAMINGO were generally consistent with observations in SINGLE.

**Laboratory Abnormalities: Treatment Experienced Patients:**

***Changes in Laboratory Chemistries***

Increases in serum creatinine occurred within the first week of treatment with dolutegravir and remained stable through 96 weeks. In SINGLE, a mean change from baseline of 12.6mmol/L was observed after 96 weeks of treatment. These changes are not considered to be clinically relevant since they do not reflect a change in glomerular filtration rate (see *Pharmacodynamics – Effects on Renal Function*).

Small increases in total bilirubin were observed on dolutegravir and raltegravir (but not efavirenz) arms in the clinical trials. These changes are not considered clinically relevant as they likely reflect competition between dolutegravir and unconjugated bilirubin for a common clearance pathway (UGT1A1) (see *Pharmacokinetics – Metabolism*).

Asymptomatic creatine phosphokinase (CPK) elevations mainly in association with exercise have also been reported with dolutegravir therapy.

***Paediatric Population***

There are no clinical study data on the effects of TRIUMEQ in the paediatric population. Individual components have been investigated in adolescents aged 12 to 18.

Based on limited available data with the dolutegravir single entity used in combination with other antiretroviral agents to treat adolescents (12 to less than 18 years of age), there were no additional types of adverse reactions beyond those observed in the adult population.

The individual preparations of ABC and 3TC have been investigated separately, and as a dual nucleoside backbone, in combination antiretroviral therapy to treat ART- naive and ART- experienced HIV- infected paediatric patients (data available on the use of ABC and 3TC in children less than three months are limited). No additional types of undesirable effects have been observed beyond those characterised for the adult population.



**Abacavir Sulfate and Lamivudine**

Laboratory abnormalities observed in clinical trials of abacavir (in combination with other antiretroviral treatment) were anemia, neutropenia, thrombocytopenia, low white blood cell count, elevated liver chemistries (AST, ALT, alkaline phosphatase, bilirubin), and elevations of CPK, blood glucose, and triglycerides. Additional laboratory abnormalities observed in clinical trials of 3TC (in combination with other antiretroviral treatment) were thrombocytopenia and elevated levels of bilirubin, amylase, and lipase.

**Post-marketing Data**

In addition to the adverse reactions included from clinical trial data, the adverse reactions listed in Table 9 below have been identified during post-approval use of abacavir and lamivudine. These events have been chosen for inclusion due to a potential causal connection to abacavir and/or lamivudine. No dolutegravir or TRIUMEQ post-marketing data are available.

**Table 9 Adverse reactions based on post-marketing experience**

<b>System organ class</b>	<b>Abacavir</b>	<b>Lamivudine</b>
Blood and lymphatic systems disorders		Very rare: pure red cell aplasia
Metabolism and nutrition disorders	Common: hyperlactataemia Rare: lactic acidosis <sup>1</sup>	Common: hyperlactataemia Rare: lactic acidosis <sup>1</sup>
Nervous system disorders		Very rare: paraesthesiae, peripheral neuropathy has been reported although a causal relationship to treatment is uncertain
Gastrointestinal disorders	Rare: pancreatitis, but a causal relationship to abacavir is uncertain	Rare: rises in serum amylase, pancreatitis, although a causal relationship to lamivudine is uncertain
Skin and subcutaneous tissue disorders	Common: rash (without systemic symptoms)  Very rare: erythema multiforme, Stevens-Johnson syndrome and toxic epidermal necrolysis	Common: alopecia
Musculoskeletal and connective tissue disorders		Common: arthralgia, muscle disorders  Rare: rhabdomyolysis

<sup>1</sup>Lactic acidosis (see *Precautions*)

Redistribution/accumulation of body fat has been observed in some patients receiving combination antiretroviral therapy (see *Precautions*). The incidence of this event is dependent on multiple factors including the particular antiretroviral drug combination.

## **DOSAGE AND ADMINISTRATION**

Therapy should be initiated by a physician experienced in the management of HIV infection.

The recommended dose of TRIUMEQ in adults and adolescents weighing at least 40 kg is one tablet once daily, taken with or without food.

Because TRIUMEQ is a fixed dose tablet, it should not be prescribed for patients requiring dose adjustment:

- Adults or adolescents weighing <40 kg
- Children < 12 years of age
- Patients with creatinine clearance <50 mL/min
- Patients with mild hepatic impairment
- Patients resistant to integrase inhibitors

## **Populations**

### ***Children***

Based on indications for use for TIVICAY [dolutegravir] and KIVEXA [abacavir/lamivudine], TRIUMEQ is indicated for use in adolescents aged 12 years and above (See Product Information for TIVICAY [dolutegravir] and KIVEXA [abacavir/lamivudine]).

TRIUMEQ is not recommended for treatment of children less than 12 years of age as the necessary dose adjustment cannot be made. Clinical data is currently not available for this combination. Physicians should refer to the individual product information for TIVICAY [dolutegravir], ZIAGEN [abacavir] and 3TC [lamivudine].

### ***Elderly***

There are limited data available on the use of dolutegravir, abacavir and lamivudine in patients aged 65 years and over. However, there is no evidence that elderly patients require a different dose than younger adult patients (*see Pharmacokinetics – Special Patient Populations*). When treating elderly patients, consideration needs to be given to the greater frequency of decreased hepatic, renal and cardiac function, concomitant medicinal products or disease.

### ***Renal Impairment***

Whilst no dosage adjustment of dolutegravir or abacavir is necessary in patients with renal impairment, a dose reduction of lamivudine is required due to decreased clearance. Therefore TRIUMEQ is not recommended for use in patients with a creatinine clearance less than 50 ml/min (*see Pharmacokinetics – Special Patient Populations*).

### ***Hepatic Impairment***

A dose reduction of abacavir may be required for patients with mild hepatic impairment (Child-Pugh grade A). As dose reduction is not possible with TRIUMEQ, the separate preparations of dolutegravir, abacavir or lamivudine should be used when this is judged necessary. TRIUMEQ is not recommended in patients with moderate and severe hepatic impairment (Child-Pugh grade B or C) (*see Pharmacokinetics – Special Patient Populations*).

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Separate preparations of dolutegravir, abacavir or lamivudine should be administered in cases where discontinuation or dose adjustment is indicated. In these cases the physician should refer to the individual product information for these medicinal products.

## **OVERDOSAGE**

### **Symptoms and Signs**

There is currently limited experience with overdose in dolutegravir.

Limited experience of single higher doses (up to 250 mg in healthy patients) revealed no specific symptoms or signs, apart from those listed as adverse reactions.

No specific symptoms or signs have been identified following acute overdose with abacavir or lamivudine, apart from those listed as adverse reactions.

### **Treatment**

Further management should be as clinically indicated or as recommended by the national poisons centre, where available.

If overdose occurs, the patient should be treated supportively with appropriate monitoring as necessary. Since lamivudine is dialysable, continuous haemodialysis could be used in the treatment of overdose, although this has not been studied. It is not known whether abacavir can be removed by peritoneal dialysis or haemodialysis. As dolutegravir is highly bound to plasma proteins, it is unlikely that it will be significantly removed by dialysis.

For information on the management of overdose, contact the Poison Information Centre on 131126 (Australia).

## **PRESENTATION AND STORAGE CONDITIONS**

Purple, film-coated, oval, biconvex tablets, debossed with '572 Tr1' on one side. Each film-coated tablet contains 50 mg of dolutegravir (as dolutegravir sodium), 600 mg of abacavir (as abacavir sulphate) and 300 mg of lamivudine.

TRIUMEQ tablets are supplied in white high density polyethylene (HDPE) bottles with child resistant closure packs containing 30 tablets.

Store below 30°C. Store in the original package in order to protect from moisture. Keep the bottle tightly closed. Do not remove the desiccant.

## **NAME AND ADDRESS OF THE SPONSOR**

ViiV Healthcare Pty Ltd,  
Level 4, 436 Johnston Street,  
Abbotsford, Victoria, 3067

## **POISON SCHEDULE OF THE MEDICINE**

Schedule 4 – Prescription Only Medicine

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**Date of first inclusion in the Australian Register of Therapeutic Goods (the ARTG):**  
14 January 2015

**Date of most recent amendment:** N/A

TRIUMEQ, TIVICAY, KIVEXA, 3TC, TRIZIVIR, ZIAGEN are registered trade marks of the ViiV Healthcare Group of Companies.

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