

# AUSTRALIAN PRODUCT INFORMATION – AUBAGIO (TERIFLUNOMIDE)

## 1 NAME OF THE MEDICINE

Teriflunomide

## 2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Each Aubagio tablet contains 14 mg teriflunomide.

Excipient with known effect: lactose monohydrate

For full list of excipients, see Section 6.1- List of excipients.

## 3 PHARMACEUTICAL FORM

Teriflunomide is formulated as film-coated tablets for oral administration.

Aubagio is available as pale blue to pastel blue, pentagonal film-coated tablets with “14” imprinted on one side and engraved with a logo on the other.

## 4 CLINICAL PARTICULARS

### 4.1 THERAPEUTIC INDICATIONS

Aubagio is indicated for the treatment of patients with relapsing forms of Multiple Sclerosis to reduce the frequency of clinical relapses and to delay the progression of physical disability.

### 4.2 DOSE AND METHOD OF ADMINISTRATION

The recommended dose of Aubagio is 14mg orally once daily. Aubagio can be taken with or without food.

### Special Populations

#### *Children*

The safety and efficacy of Aubagio in paediatric patients with MS below the age of 18 years has not yet been established.

### ***Elderly***

Clinical studies of Aubagio did not include patients over 65 years old. Aubagio should be used with caution in patients aged over 65 years.

### ***Hepatic Impairment***

No dosage adjustment is necessary for patients with mild or moderate hepatic impairment. Teriflunomide is contraindicated in patients with severe hepatic impairment (see Section 4.4 Special Warnings and Precautions for use- Hepatic Impairment).

### ***Renal Impairment***

No dosage adjustment is necessary for patients with severe renal impairment (see Section 4.4 Special Warnings and precautions for use – Renal impairment).

### ***Switching Patients from or to other disease modifying therapies***

For recommendations related to switching patients from other disease modifying therapies to Aubagio (see Section 4.4-Special Warnings and Precautions for use- Switching to or from Aubagio and Plasma Monitoring).

## **4.3 CONTRAINDICATIONS**

Aubagio must not be given to:

- patients with hypersensitivity to leflunomide, teriflunomide or to any of the excipients in the tablets
- patients with severe immunodeficiency states, e.g. AIDS
- patients with significantly impaired bone marrow function or significant anaemia, leukopenia or thrombocytopenia
- patients with severe, uncontrolled infections
- patients with severe impairment of liver function
- pregnant women (see Section 4.6 Fertility, Pregnancy and Lactation- Use in Pregnancy)
- women of childbearing potential who are not using reliable contraception during treatment with teriflunomide and for a certain period of time thereafter, as long as the plasma levels are above 0.02 mg/L, unless undergoing washout treatment (see Section 4.6- Fertility, Pregnancy and Lactation- Use in Pregnancy)
- women who are breast-feeding (see Section 4.6 Fertility, Pregnancy and Lactation- Use in Lactation)
- patients with severe hypoproteinaemia
- patients who have or have had Stevens- Johnson syndrome, toxic epidermal necrolysis, drug reaction with eosinophilia and systemic symptoms (DRESS), or erythema multiforme

## **4.4 SPECIAL WARNINGS AND PRECAUTIONS FOR USE**

### ***Hepatotoxicity***

Elevations of liver enzymes have been observed in patients receiving Aubagio. During placebo controlled trials, 3-fold the upper limit of normal (ULN) or greater elevation in liver transaminases (ALT) occurred in 6.1% of patients treated with teriflunomide 14 mg, as compared to 6.2% of patients on placebo. Elevations of 5-fold the ULN (ALT) or greater occurred in 2.6% of patients on Aubagio and 2.2% of patients on placebo. These elevations occurred mostly within the first year of treatment. In clinical trials, teriflunomide was discontinued if the ALT elevation exceeded 3 times the ULN twice. Serum transaminase levels returned to normal within approximately 2 months after discontinuation of Aubagio.

In addition, one clinically significant case of “toxic hepatitis” was reported. Although the etiology of the hepatic event remained unclear, a causal role of teriflunomide in this case is possible. In addition to a case of “toxic hepatitis” in clinical trials, cases of drug-induced liver injury (DILI) have been observed in the post-marketing setting, sometimes life-threatening, often in combination with other hepatotoxic drugs

Very rare cases of severe liver injury, with fatal outcome in isolated cases, have been reported during treatment with leflunomide, the parent compound of teriflunomide. Most of the cases occurred within the first 6 months of treatment. Although confounding factors were present in many cases, a causal relationship to leflunomide and hence teriflunomide cannot be excluded. It is considered essential that monitoring recommendations are strictly adhered to (see Liver function monitoring).

### ***Liver function monitoring***

ALT, AST and bilirubin levels must be checked within 6 months before the start of Aubagio treatment. Monitor ALT and AST at monthly or more frequent intervals for at least the first 6 months and then, if stable, every 6-8 weeks thereafter. For minor elevations in ALT or AST (<2-fold ULN), repeat testing in 2-4 weeks. For moderate elevations in ALT or AST (>2 fold but <3-fold ULN), closely monitor, with LFTs every 2-4 weeks. If ALT or AST elevations of more than 3-fold ULN are present, Aubagio should be discontinued. Cholestyramine or activated charcoal should be administered to more rapidly lower teriflunomide levels, with close monitoring including retreatment with cholestyramine or activated charcoal as indicated. Monitor serum transaminase and bilirubin on Aubagio therapy, particularly in patients who develop symptoms suggestive of hepatic dysfunction, such as unexplained nausea, vomiting, abdominal pain, fatigue, anorexia, or jaundice and/or dark urine. If liver injury is suspected to be teriflunomide -induced, discontinue Aubagio, start an accelerated elimination procedure and monitor liver tests weekly until normalized.

### ***Blood Pressure***

In placebo controlled studies, mean change from baseline for diastolic blood pressure was 1.3 mmHg and for systolic blood pressure was 2.7 mmHg for teriflunomide 14 mg. Check blood pressure before start of Aubagio treatment and periodically thereafter. Blood pressure elevation should be appropriately managed during treatment with Aubagio.

## ***Infections***

In placebo controlled studies, no significant increase in serious infections was observed with teriflunomide 14 mg (2.2%) as compared to placebo (2.1%). Serious opportunistic infections occurred in 0.2% in each group.

However, based on the immunomodulatory effect of Aubagio, if a patient develops a serious infection, consider suspending treatment with Aubagio, and reassess the benefits and risks prior to re-initiation of therapy. Due to the prolonged elimination half-life of teriflunomide, accelerated elimination with cholestyramine or charcoal may be considered (See Section 4.9 Overdose). Instruct patients receiving Aubagio to report symptoms of infections to a physician. Patients with active acute or chronic infections should not start treatment with Aubagio until the infection(s) is resolved. Aubagio is not recommended with severe immunodeficiency, bone marrow disease, or severe, uncontrolled infections.

For patients testing positive in tuberculosis screening, manage by standard medical practice prior to therapy with Aubagio.

## ***Respiratory Effects***

Interstitial lung disease, including acute interstitial pneumonitis has been reported with Aubagio in the post-marketing setting.

Interstitial lung disease and worsening of pre-existing interstitial lung disease have been reported during treatment with leflunomide. Interstitial lung disease may occur acutely at any time during therapy with a variable clinical presentation. Interstitial lung disease may be fatal. New onset or worsening pulmonary symptoms, such as cough and dyspnoea, with or without associated fever, may be a reason for discontinuation of the therapy and for further investigation as appropriate. If discontinuation of the drug is necessary, consider initiation of an accelerated elimination procedure.

## ***Haematologic Effects***

A mean decrease affecting white blood cells (WBC) count (<15%, mainly neutrophil and lymphocytes decrease) was observed in placebo controlled trials with Aubagio, although a greater decrease was observed in some patients. The decrease in mean count occurred during the first 6 weeks then stabilized over time while on treatment. The effect on red blood cells (RBC) (<2%) and platelet counts (<10%) was less pronounced. A complete blood cell count (including differential white blood cell count and platelets) should be performed in all patients before the start of Aubagio treatment and monthly for the first 6 months, followed by 6-8 weeks thereafter. In patients with pre-existing anaemia, leukopenia and/or thrombocytopenia as well as in patients with impaired bone marrow function or those at risk of bone marrow suppression, the risk for occurrence of haematological reactions is increased.

## ***Leflunomide Post-marketing Safety Information***

The following information has been derived from the Australian prescribing information for Arava® (leflunomide) and may be pertinent to understanding the safety profile of teriflunomide. Leflunomide is the parent compound of teriflunomide (Aubagio). Leflunomide is indicated in the treatment of rheumatoid arthritis. Leflunomide has been evaluated in clinical

studies in rheumatoid arthritis and has over 2 million patient-years of cumulative exposure globally in the post marketing setting. The risks associated with use of leflunomide are well characterized in the rheumatoid arthritis population and may provide insight into potential risks of teriflunomide treatment in the MS population. Please refer to the current Australian PI for Arava® (leflunomide) for additional information. The following events have been reported rarely:

- **Hepatotoxicity:** Reports of severe liver injury, including fatal liver failure
- **Haematological Effects:** Rare reports of pancytopenia, agranulocytosis and thrombocytopenia in patients receiving leflunomide alone. These events have been reported most frequently in patients who received concomitant treatment with methotrexate or other immunosuppressive agents, or who had recently discontinued these therapies; in some cases, patients had a prior history of a significant hematologic abnormality.
- **Risk of Infection:** Reports of fatal infections especially *Pneumocystis jirovecii* pneumonia and aspergillosis have been reported in patients receiving leflunomide. Most of the reports were confounded by concomitant immunosuppressant therapy and/or comorbid illness which, in addition to rheumatoid disease, may predispose patients to infection
- **Skin Disorders:** Very rare cases of Stevens Johnson syndrome or toxic epidermal necrolysis have been reported in patients treated with leflunomide, the parent compound of Aubagio. As soon as skin and/or mucosal reactions are observed which raise the suspicion of such severe reactions, Aubagio and any other possible associated medication must be discontinued, and cholestyramine or charcoal should be used immediately to reduce the plasma concentration of teriflunomide (see Section 4.9 Overdose). A complete washout is essential in such cases. In such cases re-exposure to teriflunomide is contra-indicated.
- **Respiratory:** Interstitial lung disease has been reported during treatment with leflunomide and has been associated with fatal outcomes. The risk of its occurrence is increased in patients with a history of interstitial lung disease.

### ***Immunosuppression***

Although there is no clinical experience in the following patient populations, Aubagio is not recommended for patients with severe immunodeficiency, bone marrow dysplasia, or severe uncontrolled infections because of the theoretical potential for immunosuppression. If Aubagio is used in such patients, it should be done with caution and with frequent haematologic monitoring (see Haematological effects). If evidence of bone marrow suppression occurs in a patient taking Aubagio, treatment should be stopped and cholestyramine or charcoal should be used to reduce the plasma concentration of teriflunomide (see Section 4.9 Overdose).

### ***Immunosuppressive or Immunomodulating Therapies***

As leflunomide is the parent compound of teriflunomide, co-administration of teriflunomide with leflunomide is not recommended.

Co-administration with antineoplastic or immunosuppressive therapies used for treatment of multiple sclerosis has not been evaluated.

Safety studies in which teriflunomide was concomitantly administered with other immune modulating therapies for up to one year (interferon beta, glatiramer acetate) did not reveal any specific safety concerns. The long term safety of these combinations in the treatment of multiple sclerosis has not been established.

### ***Switching to or from Aubagio***

Based on clinical data, no waiting period is required when initiating teriflunomide after interferon beta or glatiramer acetate or when starting interferon beta or glatiramer acetate, after teriflunomide.

Due to the long half-life of natalizumab, concomitant exposure, and thus concomitant immune effects, could occur for up to 2-3 months following discontinuation of natalizumab if Aubagio was immediately started. Therefore, caution is required when switching patients from natalizumab to Aubagio.

Based on the half-life of fingolimod, a 6-week interval without therapy is needed for clearance from the circulation and a 1 to 2 month period is needed for lymphocytes to return to normal range following discontinuation of fingolimod. Starting Aubagio during this interval will result in concomitant exposure to fingolimod. This may lead to an additive effect on the immune system and caution is, therefore, indicated.

In MS patients, the median terminal half-life ( $t_{1/2z}$ ) was approximately 19 days after repeated doses of 14 mg. If a decision is made to stop treatment with Aubagio, during the interval of 5 half-lives (approximately 3.5 months although may be longer in some patients), starting other therapies will result in concomitant exposure to Aubagio. In any situation in which the decision is made to switch from Aubagio to another immunomodifying agent with a known potential for haematologic suppression, it would be prudent to monitor for haematologic toxicity, because there will be overlap of systemic exposure to both compounds. Aubagio washout with cholestyramine or charcoal (accelerated elimination procedure) may decrease this risk but also may induce disease worsening if the patient had been responding to Aubagio treatment.

### ***Use in hepatic impairment***

Mild and moderate hepatic impairment had no impact on the pharmacokinetics of teriflunomide. No dosage adjustment is necessary for patients with mild or moderate hepatic impairment. Teriflunomide is contraindicated in patients with severe hepatic impairment (see Section 4.3 Contraindications).

### ***Use in renal impairment***

Leflunomide, the parent compound of teriflunomide was administered as a single oral 100 mg dose to 3 haemodialysis patients and 3 patients on continuous peritoneal dialysis (CAPD). The pharmacokinetics of teriflunomide in CAPD subjects appeared to be similar to healthy volunteers. A more rapid elimination of teriflunomide was observed in haemodialysis subjects which was not due to extraction of drug in the dialysate but instead to displacement of protein binding. Caution should be used when Aubagio is administered to patients with renal impairment.

### ***Use in the elderly***

Clinical studies of Aubagio did not include patients over 65 years old. Aubagio should be used with caution in patients aged over 65 years.

### ***Paediatric use***

The safety and effectiveness of Aubagio in paediatric patients with MS below the age of 18 years have not yet been established.

### ***Vaccination***

Two clinical studies have shown that vaccinations of inactivated neoantigen (first vaccination), or recall antigen (re-exposure) were safe and effective during Aubagio treatment. The use of live attenuated vaccines may carry a risk of infection and should therefore be avoided. Vaccination with live vaccines is not recommended. A live vaccine should only be given after a period of at least 6 months has elapsed after stopping Aubagio.

### ***Skin Reactions***

#### ***Severe cutaneous adverse reactions (SCARs)***

Cases of serious skins reactions, sometimes fatal, including Stevens-Johnson syndrome (SJS), toxic epidermal necrolysis (TEN), and drug reaction with eosinophilia and systemic symptoms (DRESS), have been reported with teriflunomide.

If skin and /or mucosal reactions (ulcerative stomatitis) are observed which raise the suspicion of severe generalised major skin reactions (Stevens-Johnson syndrome, toxic epidermal necrolysis-Lyell's syndrome, or drug reaction with eosinophilia and systemic symptoms), teriflunomide and any other possibly associated treatment must be discontinued, and an accelerated elimination procedure initiated immediately. In such cases patients should not be re-exposed to teriflunomide (see Section 4.3 Contraindications).

### ***Peripheral neuropathy***

In placebo-controlled studies, peripheral neuropathy was reported more frequently in patients taking Aubagio than in patients taking placebo. In one 108-week placebo-controlled study in 1086 patients with multiple sclerosis, the incidence of peripheral neuropathy confirmed by nerve conduction studies was 1.9% (6 patients) on 14 mg Aubagio respectively and 0% on placebo. This included polyneuropathy and mononeuropathy (e.g. carpal tunnel syndrome). Treatment was discontinued in one patient with polyneuropathy.

Cases of peripheral neuropathy have been reported in patients receiving Aubagio. However, there was a wide variability in final outcome, i.e. in some patients the neuropathy resolved and some patients had persistent symptoms. If a patient taking Aubagio develops symptoms consistent with peripheral neuropathy, such as bilateral numbness or tingling of hands or feet, consider discontinuing Aubagio therapy and performing an accelerated elimination procedure.

### ***Accelerated Elimination Procedure***

Teriflunomide is eliminated slowly from the plasma. When desired, an accelerated elimination procedure can be used.

Teriflunomide concentrations measured during an 11-day procedure to accelerate teriflunomide elimination with either 4 g cholestyramine t.i.d, 8 g cholestyramine t.i.d or 50 g activated charcoal b.i.d following cessation of teriflunomide treatment have shown that these regimens were effective in accelerating teriflunomide elimination, leading to more than 98% decrease in teriflunomide plasma concentrations, with cholestyramine being faster than charcoal. In association with this procedure a higher incidence among patients taking teriflunomide 14mg was seen of the AEs nausea (3.3% vs 1.5% placebo), vomiting (2.4% vs 0% placebo), and increased ALT (1.6% vs. 0 placebo). When desired, elimination can be accelerated by any of the following procedures: (See Section 4.9 Overdose - Accelerated Elimination Procedure: Cholestyramine and activated charcoal).

Administration of cholestyramine 4 g or 8 g every 8 hours for 11 days or by 50 g oral activated charcoal powder administered every 12 hours for 11 days (days do not need to be consecutive unless there is a need to lower teriflunomide plasma concentration rapidly). Following discontinuation of teriflunomide and the administration of cholestyramine 8 g three times a day, the plasma concentration of teriflunomide is reduced 99% at the completion of day 11. If cholestyramine 8 g three times a day is not well tolerated, cholestyramine 4 g three times a day can be used.

Both cholestyramine and activated charcoal may influence the absorption of oestrogens and progestogens such that reliable contraception with oral contraceptives may not be guaranteed during the washout procedure with cholestyramine and activated charcoal. Use of alternative contraceptive methods is recommended.

### ***Plasma monitoring***

After the wash-out procedure has been performed, teriflunomide plasma levels of < 0.02 mg/L must be verified by 2 separate tests at least 14 days apart. Human teriflunomide plasma concentrations less than or equal to 0.02 mg/L are expected to have minimal risk based on available data. Without the drug elimination procedure, it may take up to 2 years to reach teriflunomide concentrations <0.02 mg/L (after stopping treatment with Aubagio), due to individual variation in drug clearance. However, verification of teriflunomide levels <0.02 mg/L by 2 separate tests at an interval of at least 14 days is required

In pregnant women and women currently attempting to become pregnant, plasma concentrations should be verified to be equal or less than 0.02 mg/L. If plasma concentrations are higher than 0.02 mg/L, additional elimination should be considered.

### ***Effects on laboratory tests***

No data available.



## 4.5 INTERACTIONS WITH OTHER MEDICINES AND OTHER FORMS OF INTERACTIONS

The primary biotransformation pathway for teriflunomide is hydrolysis, with oxidation being a minor pathway. The extensive protein binding of teriflunomide could lead to displacement of other highly bound drugs.

### Potential for Other Drugs to affect Teriflunomide

#### ***Potent CYP and transport inducers***

Co-administration of repeated doses (600 mg once daily for 22 days) of rifampicin (a CYP2B6, 2C8, 2C9, 2C19, 3A inducer, as well as an inducer of the efflux transporters P-gp and BCRP) and teriflunomide (70 mg single dose) resulted in an approximately 40% decrease in teriflunomide exposure. Rifampicin and other known potent CYP and transporter inducers such as carbamazepine, phenobarbital, phenytoin and St John's Wort should be used with caution during the treatment with teriflunomide.

#### **Potential for Teriflunomide to affect other drugs**

Repeated administration of teriflunomide was used to assess the effect of teriflunomide on the exposure of other drugs. The regimen used resulted in teriflunomide plasma concentrations which were in the range of the ones observed in patients after repeated doses of 14 mg teriflunomide.

#### ***CYP2C8 substrates:***

There was an increase in mean repaglinide  $C_{\max}$  and AUC (1.7- and 2.4-fold, respectively), following repeated doses of teriflunomide, suggesting that teriflunomide is an inhibitor of CYP2C8 *in vivo*. Therefore, monitoring patients with concomitant use of drugs metabolized by CYP2C8, such as repaglinide, paclitaxel, pioglitazone, or rosiglitazone is recommended as they may have higher exposure.

#### ***Oral contraceptives:***

There was an increase in mean ethinylloestradiol  $C_{\max}$  and AUC<sub>0-24</sub> (1.58- and 1.54-fold, respectively) and levonorgestrel  $C_{\max}$  and AUC<sub>0-24</sub> (1.33- and 1.41-fold, respectively) following repeated doses of teriflunomide. While this interaction of teriflunomide is not expected to adversely impact the efficacy of oral contraceptives, consideration should be given to the type of oral contraceptive treatment used in combination with teriflunomide.

#### ***CYP1A2 substrates***

Repeated doses of teriflunomide decreased mean  $C_{\max}$  and AUC of caffeine (CYP1A2 substrate) by 18% and 55%, respectively, suggesting that *in vivo* teriflunomide is a weak inducer of CYP1A2. Therefore, drugs metabolised by CYP1A2 (such as duloxetine, ondansetron, theophylline and agomelatine) should be used with caution during treatment with teriflunomide, as it could lead to the reduction of efficacy of these drugs.

## **Warfarin**

A 25% decrease in peak international normalized ratio (INR) was observed when teriflunomide was coadministered with warfarin as compared with warfarin alone. Therefore, when warfarin is coadministered with teriflunomide, close INR follow-up and monitoring is recommended.

## **Effect of teriflunomide on organic anion transporter 3 (OAT3) substrates**

There was an increase in mean cefaclor  $C_{max}$  and AUC (1.43- and 1.54-fold, respectively), following repeated doses of teriflunomide, suggesting that teriflunomide is an inhibitor of OAT3 in vivo. Therefore, when teriflunomide is coadministered with substrates of OAT3, such as cefaclor, penicillin G, ciprofloxacin, indomethacin, ketoprofen, furosemide, cimetidine, methotrexate, zidovudine, caution should be observed.

## **Effect of teriflunomide on BCRP and/or organic anion transporting polypeptide B1 and B3 (OATP1B1/B3) substrates:**

There was an increase in mean rosuvastatin  $C_{max}$  and AUC (2.65- and 2.51-fold, respectively), following repeated doses of teriflunomide. However there was no apparent impact of this increase in plasma rosuvastatin exposure on the HMG-CoA reductase activity. If used together, the dose of rosuvastatin should not exceed 10 mg once daily. For other substrates of BCRP (eg, methotrexate, topotecan, sulfasalazine, daunorubicin, doxorubicin) and the OATP family especially HMG-Co reductase inhibitors (eg, simvastatin, atorvastatin, pravastatin, methotrexate, nateglinide, repaglinide, rifampicin) concomitant administration of teriflunomide should also be undertaken with caution. Monitor patients closely for signs and symptoms of excessive exposure to the drugs and consider reduction of the dose of these drugs.

## **CYP2B6, CYP3A, CYP2C9, CYP2C19 and CYP2D6 substrates**

Teriflunomide did not affect the pharmacokinetics of bupropion (a CYP2B6 substrate), midazolam (a CYP3A substrate), S-warfarin (a CYP2C9 substrate), omeprazole (a CYP2C19 substrate) and metoprolol (a CYP2D6 substrate) at the anticipated therapeutic dose.

## **NSAIDS**

NSAIDS (including COX-2 inhibitors) are known to cause hepatotoxicity, therefore caution is advised when Aubagio is used concomitantly. Studies showed that ibuprofen and diclofenac did not displace teriflunomide. Teriflunomide displaced ibuprofen and diclofenac and the unbound fraction of these drugs was increased by 10 - 50%. In clinical trials, no safety problems were observed when leflunomide, the parent compound of teriflunomide and NSAIDs metabolised by CYP2C9 were co-administered.

## **4.6 FERTILITY, PREGNANCY AND LACTATION**

### **Effects on fertility**

Oral administration of teriflunomide 10mg/kg/day (about 6 times the RHD based on mg/m<sup>2</sup>) to male rats impaired spermatogenesis but had no effect on fertility; the no-effect dose was 3mg/kg/day. Oral treatment of female rats with teriflunomide from two weeks prior to mating through to implantation (gestation day 6) caused almost complete embryofoetal death and

isolated malformations in surviving fetuses at doses of 2.6mg/kg/day and above (about twice the RHD based on mg/m<sup>2</sup>; the no-effect dose was 0.84mg/kg/day). Estimated systemic exposure (plasma AUC) in these studies was less than anticipated clinical exposure.

### ***Use in pregnancy (Category X)***

As teriflunomide is teratogenic in rats and rabbits, it may cause foetal harm in humans. Aubagio must not be given to pregnant women, or women of childbearing potential who are not using reliable contraception during treatment with Aubagio and for a certain period of time thereafter as long as the plasma levels are above 0.02 mg/L, unless undergoing washout treatment (waiting period or accelerated elimination procedure; see below). Pregnancy must be excluded before the start of treatment with Aubagio.

It is recommended that women of childbearing potential only receive Aubagio after it has been confirmed that they are using a reliable form of contraception. In a study in which leflunomide, the parent compound of teriflunomide, was given to healthy female volunteers concomitantly with a triphasic oral contraceptive pill containing 30 µg ethinyloestradiol, there was no reduction in contraceptive activity of the pill, and teriflunomide pharmacokinetics were within predicted ranges.

Patients must be advised that if there is any delay in the onset of menses or any other reason to suspect pregnancy, they must notify their physician immediately to test for pregnancy. If the test is positive, the physician and patient must discuss the risk to the foetus. It is possible that by rapidly lowering the blood level of the active metabolite at the first delay of menses, using the drug elimination procedure described below, the risk to the foetus may be decreased.

### ***Human Experience***

There is limited human experience from clinical studies with Aubagio. A total of 31 patients became pregnant during clinical studies while using teriflunomide. A total of 7 patients were reported having pregnancy with live birth outcome. All of these patients underwent an accelerated elimination procedure. Maternal exposure to teriflunomide was between 5 weeks and 489 weeks. The foetal exposure was from a few days to 11 weeks prior to the accelerated elimination procedure. All seven patients exposed to teriflunomide gave birth to normal healthy newborns, without evidence of structural or functional defects. Of the remaining pregnancies, 13 were electively terminated, 8 resulted in miscarriages and three were ongoing. Due to the limited nature of these data no firm conclusions can be drawn regarding the use of teriflunomide in pregnant women. Aubagio is contraindicated in women who are pregnant or currently attempting to become pregnant (see Section 4.3 Contraindications).

Available human data from pregnancy registries, clinical trials, pharmacovigilance cases, and published literature are too limited to draw any conclusions, but they do not clearly indicate increased birth defects or miscarriage associated with inadvertent teriflunomide exposure in the early first trimester when followed by an accelerated elimination procedure. There are no human data pertaining to exposures later in the first trimester or beyond.

Prospectively reported data (from clinical trials and postmarketing reports) from >150 pregnancies in patients treated with teriflunomide and >300 pregnancies in patients treated with leflunomide have not demonstrated an increased rate of congenital malformations or miscarriage following teriflunomide exposure in the early first trimester when followed by an

accelerated elimination procedure. Specific patterns of major congenital malformations in humans have not been observed. Limitations of these data include an insufficient number of reported pregnancies, the short duration of drug exposure in reported pregnancies, incomplete reporting, and the inability to control for confounders (such as underlying maternal disease and use of concomitant medications)

### ***Pregnancy Registry***

A pregnancy registry has been established to collect information about the effect of Aubagio use during pregnancy. If physicians or patients become aware of pregnancy during treatment with Aubagio, they are encouraged to enrol the patient in the Aubagio pregnancy registry.

### ***Labour and Delivery***

There is no adequate information regarding the effects of Aubagio on labour and delivery in pregnant women.

### ***Use in lactation***

Animal studies indicate that teriflunomide passes into milk and can cause harm to the developing neonate at subclinical maternal exposures. Up to 23% of a maternal dose was ingested by suckling rat pups. Because many drugs are excreted in human milk and because of the potential for serious adverse reactions in nursing infants from Aubagio, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother.

### ***Use in males***

The risk of male-mediated embryo-foetal toxicity through teriflunomide treatment is considered low. The estimated female plasma exposure via the semen of a treated patient is expected to be 100 times lower than the plasma exposure observed at steady state after 14 mg of oral teriflunomide. There were no external malformations in the offspring of male rats administered teriflunomide for at least 10 weeks prior to mating with untreated female rats at oral doses up to 10mg/kg/day (about 6 times the RHD based on mg/m<sup>2</sup>).

## **4.7 EFFECTS ON ABILITY TO DRIVE AND USE MACHINES**

The effects of this medicine on a person's ability to drive and use machines were not assessed as part of its registration.

## **4.8 ADVERSE EFFECTS (UNDESIRABLE EFFECTS)**

The most frequent adverse reactions for Aubagio (incidence  $\geq 10\%$  and  $\geq 2\%$  greater than placebo) in the placebo-controlled studies were diarrhoea, nausea, alopecia, ALT increased.

If desired, teriflunomide can be rapidly cleared from the body by the use of the accelerated elimination procedure (see Section 4.9- Overdose).

## Reporting suspected adverse effects

Reporting suspected adverse reactions after registration of the medicinal product is important. It allows continued monitoring of the benefit-risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions at [www.tga.gov.au/reporting-problems](http://www.tga.gov.au/reporting-problems) (Australia) or <https://nzphvc.otago.ac.nz/reporting/> (New Zealand).

## Clinical Trial Experience

A total of 2047 patients on teriflunomide (7 or 14 mg once daily) and 997 on placebo constituted the safety population in the pooled analysis of placebo controlled studies in patients with relapsing forms of MS (RMS).

**Table 1 - Adverse Events in placebo controlled studies (occurring in  $\geq 1\%$  of patients, and reported for teriflunomide 14 mg at  $\geq 1\%$  higher rate than for placebo)**

<b>PRIMARY SYSTEM ORGAN CLASS Preferred Term n (%)</b>	<b>teriflunomide 14 mg (N=1002)</b>	<b>Placebo (N=997)</b>
<b>Infections and Infestations</b>		
Influenza	88 (8.8%)	70 (7.0%)
Sinusitis	53 (5.3%)	42 (4.2%)
Gastroenteritis viral	24 (2.4%)	11 (1.1%)
<b>Blood and lymphatic system disorders</b>		
Neutropenia	59 (5.9%)	19 (1.9%)
<b>Nervous system disorders</b>		
Paraesthesia	88 (8.8%)	67 (6.7%)
<b>Vascular disorders</b>		
Hypertension	43 (4.3%)	18 (1.8%)
<b>Gastrointestinal disorders</b>		
Diarrhoea	136 (13.6%)	75 (7.5%)
Nausea	107 (10.7%)	72 (7.2%)
Abdominal pain upper	50 (5.0%)	36 (3.6%)
Toothache	29 (2.9%)	18 (1.8%)
<b>Skin and subcutaneous tissue disorders</b>		
Alopecia <sup>a</sup>	135 (13.5%)	50 (5.0%)
Rash	45 (4.5%)	32 (3.2%)
<b>Musculoskeletal and connective tissue disorders</b>		
Musculoskeletal pain	33 (3.3%)	21 (2.1%)
<b>Reproductive system and breast disorders</b>		
Menorrhagia	16 (1.6%)	4 (0.4%)
<b>Investigations</b>		

<b>PRIMARY SYSTEM ORGAN CLASS</b> <b>Preferred Term n (%)</b>	<b>teriflunomide</b> <b>14 mg</b> <b>(N=1002)</b>	<b>Placebo</b> <b>(N=997)</b>
Alanine aminotransferase increased (ALT)	150 (15.0%)	89 (8.9%)
Gamma-glutamyltransferase increased (GGT)	24 (2.4%)	9 (0.9%)
Aspartate aminotransferase increased (AST)	34 (3.4%)	17 (1.7%)
Weight decreased	24 (2.4%)	8 (0.8%)
Neutrophil count decreased	22 (2.2%)	11 (1.1%)

a: most cases reported as hair thinning, decrease hair density, hair loss, associated or not with hair texture change, most often described as diffuse or generalized over the scalp (no complete hair loss reported ) with a high probability of occurrence during the first 6 months with spontaneous resolution even on-treatment for some patients or after study medication discontinuation for others.

Headache, palpitations, arthralgia, myalgia, increased blood creatine phosphokinase and decreased white blood cell count were also observed.

Clinically relevant adverse reactions in the placebo controlled studies, listed in CIOMS format by System Organ Class are shown in [Table 2](#).

The following CIOMS frequency rating is used, when applicable:

*Very common*  $\geq 10\%$ ; *Common*  $\geq 1$  and  $< 10\%$ ; *Uncommon*  $\geq 0.1$  and  $< 1\%$ ; *Rare*  $\geq 0.01$  and  $< 0.1\%$ ; *Very rare*  $< 0.01\%$ , *Unknown* (cannot be estimated from available data).

**Table 2 - Adverse Reactions in placebo controlled studies in CIOMS format**

<b>System organ class</b>	<b>Very common (<math>\geq 1/10</math>)</b>	<b>Common (<math>\geq 1/100</math> to <math>&lt; 1/10</math>)</b>	<b>Uncommon (<math>\geq 1/1000</math> to <math>&lt; 1/100</math>)</b>	<b>Rare (<math>\geq 1/10,000</math> to <math>&lt; 1/1,000</math>)</b>	<b>Very Rare (<math>&lt; 1/10,000</math>)</b>
Infections and Infestations		Influenza Sinusitis Gastroenteritis viral Neutropenia	Lymphopenia		
Blood and lymphatic system disorders			Mild thrombocytopenia (platelets $< 100$ G/l)		
Metabolism and nutrition disorders			Hyperamylasaemia		
Nervous system disorders		Paraesthesia	Dysgeusia Peripheral neuropathy Polyneuropathy Neuralgia Hyperesthesia		
Vascular disorders		Hypertension			

System organ class	Very common (≥1/10 )	Common (≥1/100 to <1/10 )	Uncommon (≥1/1000 to <1/100 )	Rare (≥ 1/10,000 to < 1/1,000)	Very Rare (< 1/10,000)
Respiratory, thoracic and mediastinal disorders					Interstitial lung disease*
Gastrointestinal disorders	Diarrhoea Nausea	Abdominal pain upper Toothache			Pancreatitis*
Skin and subcutaneous tissue disorders	Alopecia	Rash	Pruritus generalised		
Musculoskeletal and connective tissue disorders		Musculoskeletal pain Myalgia			
Reproductive system and breast disorders		Menorrhagia			
	Alanine aminotransferase (ALT) increased	Gamma-glutamyltransferase (GGT) increased	Blood creatinine increased		
Investigations		Aspartate aminotransferase (AST) increased Weight decreased Neutrophil count decreased White blood cell count decreased			
Injury, poisoning and procedural complications			Post-traumatic pain		

\*Based on leflunomide data only

### ***Polyneuropathy***

In the pivotal, placebo-controlled studies, the incidence of peripheral neuropathy confirmed by nerve conduction studies was 1.8% (17 patients) on 14 mg of Aubagio, compared with 0.4% on placebo (4 patients). Treatment was discontinued in 8 patients with confirmed peripheral neuropathy (3 on teriflunomide 7 mg and 5 on teriflunomide 14 mg). Four of them recovered following treatment discontinuation. Not all cases of peripheral neuropathy resolved with continued treatment.

## Post-Marketing Experience

In post-marketing experience with Aubagio, the following adverse reactions have been identified:

### *Immune System Disorders*

Hypersensitivity reactions (immediate or delayed) some of which were severe, such as anaphylaxis, and angioedema.

### *Skin and Subcutaneous Tissue Disorders*

Severe skin reactions including toxic epidermal necrolysis (TEN), Stevens-Johnson syndrome (SJS), and drug reaction with eosinophilia and systemic symptoms (DRESS)

Psoriasis (including pustular psoriasis and nail psoriasis)

Nail disorders

### *Respiratory, Thoracic and Mediastinal Disorders*

Interstitial Lung Disease (ILD)

### *Gastrointestinal Disorders*

Stomatitis (such as aphthous or ulcerative),

Pancreatitis

Colitis

### *Hepatobiliary Disorders*

Drug-induced liver injury (DILI)

Because these reactions are reported voluntarily from a population of uncertain size, it is not possible to reliably estimate their frequency.

## 4.9 OVERDOSE

There is no experience regarding teriflunomide overdose or intoxication in humans. Teriflunomide 70 mg daily up to 14 days was well tolerated by healthy subjects.

In the event of relevant overdose or toxicity, cholestyramine or activated charcoal is recommended to accelerate elimination (see Section 4.4- Special warnings and precautions for use).

### **Accelerated Elimination Procedure: Cholestyramine and activated charcoal**

The elimination of teriflunomide from the circulation can be accelerated by administration of cholestyramine or activated charcoal, presumably by interrupting the reabsorption processes at the intestinal level. Teriflunomide concentrations measured during an 11-day procedure to



accelerate teriflunomide elimination with either 4 g cholestyramine t.i.d, 8 g cholestyramine t.i.d or 50 g activated charcoal b.i.d following cessation of teriflunomide treatment have shown that these regimens were effective in accelerating teriflunomide elimination, leading to more than 98% decrease in teriflunomide plasma concentrations, with cholestyramine being faster than charcoal. In association with this procedure a higher incidence among patients taking teriflunomide 14mg was seen of the AEs nausea (3.3 vs 1.5% placebo), vomiting (2.4% vs 0% placebo), increased ALT (1.6% vs. 0 placebo). The choice between the 3 elimination procedures should depend on the patient's tolerability. If cholestyramine 8 g three times a day is not well tolerated, cholestyramine 4 g three times a day can be used. Alternatively, activated charcoal may also be used (The 11 days do not need to be consecutive unless there is a need to lower teriflunomide plasma concentration rapidly).

Use of the accelerated elimination procedure may potentially result in return of disease activity if the patient had been responding to Aubagio treatment.

For information on the management of overdose, contact the Poisons Information Centre, on 13 11 26 (Australia) or the National Poisons Centre, 0800 POISON or 0800 764 766 (New Zealand).

## **5 PHARMACOLOGICAL PROPERTIES**

### **5.1 PHARMACODYNAMIC PROPERTIES**

#### ***Mechanism of action***

Teriflunomide is an immunomodulatory agent with anti-inflammatory properties that selectively and reversibly inhibits the mitochondrial enzyme dihydroorotate dehydrogenase (DHO-DH), required for the de novo pyrimidine synthesis. As a consequence teriflunomide blocks the activation and proliferation of stimulated lymphocytes which need de novo synthesis of pyrimidine to expand. Slowly dividing or resting cells which rely on the salvage pathway for pyrimidine synthesis are unaffected by teriflunomide. The exact mechanism by which teriflunomide exerts its therapeutic effect in MS is not fully understood, but may include reduced number of activated lymphocytes in CNS. It is likely that teriflunomide diminishes in periphery the numbers of activated lymphocytes available to migrate into the CNS.

#### ***Immune system***

##### ***Effects on immune cell numbers in the blood***

In the placebo controlled studies, teriflunomide 14 mg once a day led to a mild mean reduction in lymphocyte count, of  $0.3 \times 10^9/L$ , most of which occurred over the first 3 months of treatment following which levels were maintained until the end of the treatment.

##### ***Potential to prolong the QT interval***

In a placebo controlled thorough QT study performed in healthy subjects, teriflunomide at mean steady state concentrations did not show any potential for prolonging the QTcF interval compared with placebo: the largest time matched mean difference between teriflunomide and placebo was 3.46 ms with the upper bound of the 90% CI being 6.45 ms. In addition, no QTcF values were  $\geq 480$  ms and no changes from baseline were  $>60$  ms.

### **Effect on renal tubular functions**

In the placebo controlled studies, mean decreases in serum uric acid at a range of 20 to 30% were observed in patients treated with teriflunomide compared to placebo. Mean decrease in serum phosphorus was 10% in the teriflunomide group compared to placebo. These effects are considered to be related to increase in renal tubular excretion and not related to changes in glomerular functions.

### **Clinical Trials**

The efficacy of Aubagio was established by one phase 2 and two phase 3, placebo-controlled studies in patients with relapsing forms of RMS, one phase 3 active comparator study and one phase 3, placebo-controlled study in patients with early MS (i.e., with a first clinical episode).

Study 1 (EFC6049/TEMSO) was a double-blind, placebo-controlled study that evaluated once daily doses of teriflunomide 7 mg and 14 mg in patients with relapsing forms of multiple sclerosis (RMS) over 108 weeks.

One thousand eighty-eight patients with RMS were randomised to receive 7 mg (n=366) or 14 mg (n=359) of Aubagio or placebo (n= 363) for 108 weeks duration. All patients had a definite diagnosis (based on MacDonald criteria) of MS exhibiting a relapsing clinical course, with or without progression, and experienced at least 1 relapse over the year preceding the trial or at least 2 relapses over the 2 years preceding the trial. At entry, patients had an Expanded Disability Status Scale (EDSS) score  $\leq 5.5$ . The mean age of the study population was 37.9 years.

The primary endpoint was the annualised relapse rate (ARR). The annualised relapse rate was significantly lower in patients treated with Aubagio than in patients who received placebo. The key secondary endpoint was the time to disability progression, sustained for 12 weeks. Risk of disability progression was statistically significantly reduced in the teriflunomide 14 mg group compared to placebo. A statistically significant difference in disability progression sustained for 24 weeks was not demonstrated. The estimated proportion of patients free of relapses at Week 108 was 45.6% in the placebo group and 56.5% in the teriflunomide 14 mg group. Aubagio effects on magnetic resonance imaging (MRI) variables (burden of disease defined as the total volume of all abnormal brain tissue lesions, and other MRI variables) were assessed. The results indicated that Aubagio 14 mg is more efficacious in disability progression and MRI parameters than Aubagio 7 mg. The results for this study are shown in [Table 3](#) and [Figure 1](#)

**Table 3 - Clinical and MRI Results of EFC6049/TEMSO Study**

	<b>Aubagio 14 mg (N=358*)</b>	<b>Placebo (N=363)</b>	<b>Aubagio 14 mg versus Placebo</b>
<b>Clinical Endpoints</b>			
ARR: adjusted (primary endpoint)	0.369	0.539	RRa (95% CI): 0.69 (0.55, 0.85) 0.0005b
Probability of disability progression at Week 108	20.2%	27.3%	HRc (95% CI): 0.70 (0.51, 0.97) 0.0279b

	<b>Aubagio 14 mg (N=358*)</b>	<b>Placebo (N=363)</b>	<b>Aubagio 14 mg versus Placebo</b>
<b>MRI Endpoint</b>			
Burden of disease (mL)			
Mean (SD) change from baseline at Week 108	0.723 (7.59)	2.208 (7.00)	
Mean (SD) [LSM (SE)] change in absolute value of cubic root transformed BOD from baseline at Week 108	0.045 (0.30) [0.043 (0.02)]	0.111 (0.31) [0.132 (0.02)]	LSM mean difference (SE) from placebo: -0.089 (0.025) 0.0003b
Number of Gd-enhancing T1 lesion per MRI scan at Week 108	0.261	1.331	RRa (95% CI): 0.196 (0.120, 0.321) <0.0001b
Volume of hypointense T1 lesions (ml)			
Mean (SD) change from baseline at Week 108	0.331 (1.012)	0.533 (1.063)	
LS Mean (SE) change from baseline at Week 108	0.066 (0.009)	0.096 (0.009)	LSM mean difference (SE) from placebo: - 0.030 (0.013) 0.0161b

\*One patient randomized to teriflunomide 14mg was not treated.

a: Relative risk

b: p value

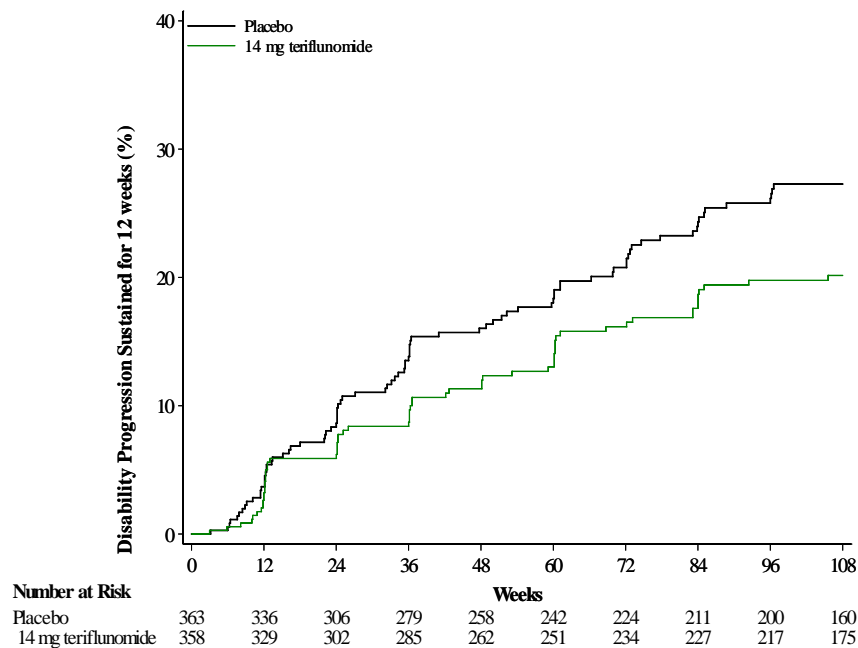
c: Hazard ratio

ARR – Annualised Relapse Rate

BOD – Burden of disease

HR – Hazard Ratio

**Figure 1 - Kaplan-Meier plot of time to disability progression sustained for 12 weeks - ITT population (EFC6049/TEMSO)**



The probability of disability progression at 108 weeks (with 90% CIs) was 0.273 (0.223, 0.323) for placebo and 0.202 (0.156, 0.247) for teriflunomide 14mg.

Study 2 (EFC10531/TOWER) was a double-blind, placebo-controlled study that evaluated once daily doses of teriflunomide 7 mg and 14 mg in patients with relapsing forms of multiple sclerosis (RMS) with a variable treatment duration (mean approximately 18 months). All patients had a definite diagnosis of MS exhibiting a relapsing clinical course, with or without progression, and experienced at least 1 relapse over the year preceding the trial or at least 2 relapses over the 2 years preceding the trial. Subjects had not received interferon-beta or any other preventive MS medications for at least 3 months before entering the study nor were these medications permitted during the study. Neurological evaluations were performed at screening, at every 12 weeks until completion, and at unscheduled visits for suspected relapse. The primary endpoint was the annualized relapse rate (ARR).

A total of 1169 patients were randomized to receive 7 mg (n=408) or 14 mg (n=372) of teriflunomide or placebo (n=389). The mean age was 37.9 years the mean disease duration was 5.16 years, and the mean EDSS at baseline was 2.69 for placebo and 2.71 for 14mg. A majority of the patients had relapsing remitting MS (97.5%). The mean time on placebo was 571 days and on 14 mg Aubagio 567 days.

The ARR was significantly reduced in patients treated with 14 mg of Aubagio compared to patients who received placebo (see [Table 4](#)).

The risk of disability progression sustained for 12 weeks (as measured by at least a 1-point increase from baseline EDSS  $\leq 5.5$  or a 0.5 point increase for those with a baseline EDSS  $> 5.5$ ) was statistically significantly reduced only in the teriflunomide 14 mg group compared to placebo ([Table 4](#) and [Figure 2](#)).

**Table 4 - Clinical Results of EFC10531/TOWER Study**

	<b>Aubagio 14 mg (N=370)</b>	<b>Placebo (N=388)</b>	<b>Aubagio 14 mg versus Placebo</b>
<b>Clinical Endpoints</b>			
ARR: adjusted (primary endpoint)	0.319	0.501	RR <sup>a</sup> (95% CI): 0.64 (0.51, 0.79) 0.0001 <sup>b</sup>
Probability of disability progression at Week 108	15.8 %	19.7 %	HR <sup>c</sup> (95% CI): 0.68 (0.47, 1.00) 0.0442 <sup>b</sup>

a: Relative risk

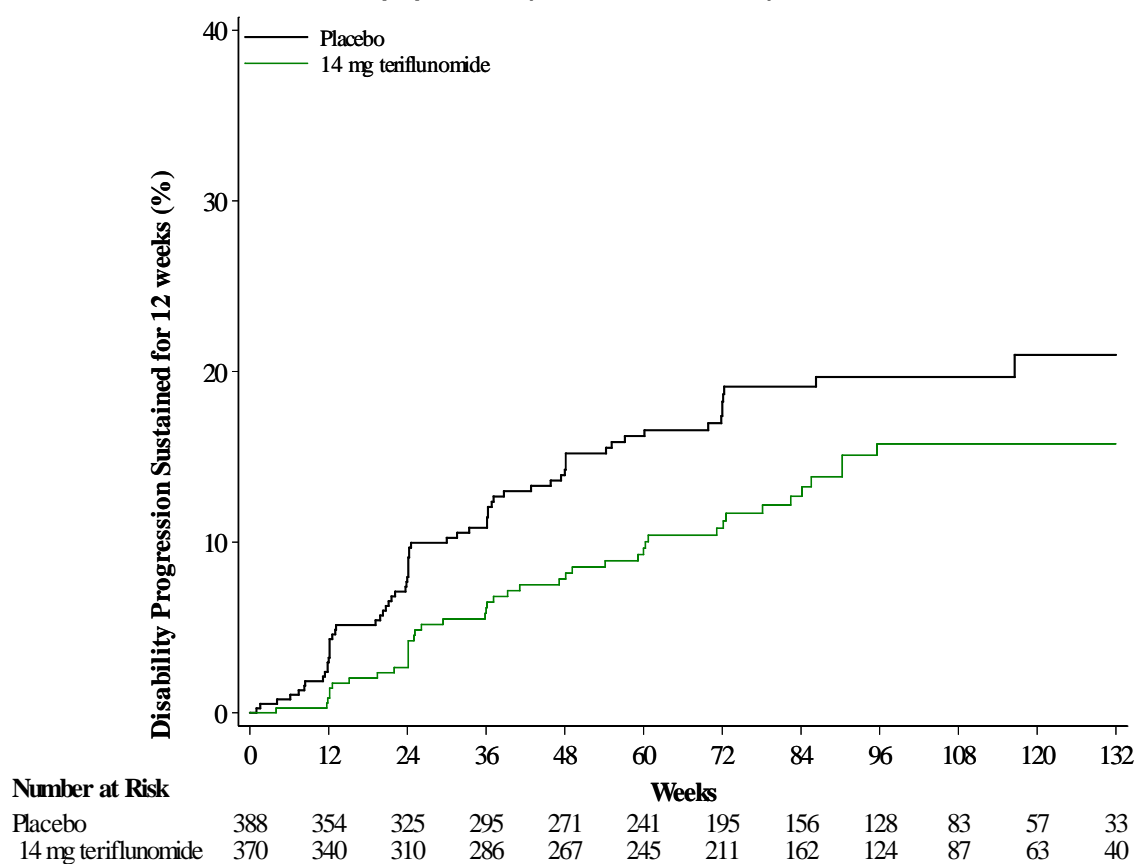
b: p value

c: Hazard ratio - Derived using Cox proportional hazard model with treatment, EDSS strata at baseline and region as covariates.

ARR – Annualised Relapse Rate

HR – Hazard Ratio

**Figure 2 - Kaplan – Meier plot of time to disability progression sustained for 12 weeks – ITT population (EFC10531/TOWER)**



Study 3 (EFC6260/TOPIC) was a double-blind, placebo-controlled study that evaluated once daily doses of teriflunomide 7 mg and 14 mg for up to 108 weeks in patients with early MS (i.e., a first clinical episode). Patients had a first neurological event occurring within 90 days of randomization, with 2 or more T2 lesions at least 3 mm in diameter that were characteristic of MS. The primary endpoint was time to a second clinical episode (relapse).

A total of 618 patients were randomized to receive 7 mg (n=205) or 14 mg (n=216) of teriflunomide or placebo (n=197). The mean age of the study population was 32.1 years and the mean time since first neurological event was 1.85 months, 59.1% of the patients entered the study with monofocal episode, and 40.9% with a multifocal episode. The mean time on placebo was 464 days, and on 14 mg Aubagio 493 days.

The risk of a second clinical episode was statistically significantly reduced in the teriflunomide 14 mg group compared to placebo ([Table 5](#)).

**Table 5 - Clinical Results of EFC6260/TOPIC**

	<b>Aubagio 14 mg (N=214)</b>	<b>Placebo (N=197)</b>	<b>Aubagio 14 mg versus Placebo</b>
<b>Clinical Endpoints</b>			
Percent of patients remaining free of a second clinical episode at week 108 (primary endpoint)	76.0%	64.1%	HR <sup>a</sup> (95% CI): 0.57 (0.38, 0.87) 0.0087 <sup>b</sup>
Percent of patients remaining free of a second clinical episode and new MRI lesion at week 108	28.5%	13.0%	HR <sup>a</sup> (95% CI): 0.65 (0.52, 0.82) 0.0003 <sup>b</sup>

a: Hazard ratio

b: p value

The Aubagio MRI activity was also shown in a phase 2 study (study 4 (Study 2001)). A total of 179 patients received 7 mg (n=61) or 14 mg (n=57) of Augabio or placebo (n= 61) for 36 weeks duration. Baseline demographics were consistent across treatment groups. The mean number of unique active lesions per brain MRI scan during the 36-week treatment period was lower in patients treated with Aubagio 14 mg (0.98) as compared to placebo (2.69), the difference being statistically significant (p=0.0052).

Study 5 (EFC10891/TENERE) was a multi-centre, randomized, parallel-group, rater-blinded study comparing the effectiveness and safety of teriflunomide and interferon beta 1a in patients with relapsing multiple sclerosis plus a long-term extension period. Teriflunomide effectiveness was compared to that of a subcutaneous interferon beta-1a (at the recommended dose of 44 µg three times a week) in 324 randomized patients in a study with minimum treatment duration of 48 weeks (maximum 114 weeks). The risk of failure (confirmed relapse or permanent treatment discontinuation whichever came first) was the primary endpoint. Teriflunomide 14 mg/day was not statistically superior to interferon beta-1a on the primary end point: the estimated percentage of patients with treatment failure at 96 weeks using the Kaplan-Meier method was 41.1% versus 44.4% (teriflunomide 14 mg versus interferon beta-1a group, p=0.595).

## 5.2 PHARMACOKINETIC PROPERTIES

### **Absorption**

Median time to reach maximum plasma concentrations occurs between 1 to 4 hours post-dose following repeated oral administration of teriflunomide, with high bioavailability (~100%) determined by cross study comparison. Food produced a statistically significant decrease in  $C_{max}$  (18%) and an increase in  $t_{max}$  (~ 3 hours), that does not have a clinically relevant effect on teriflunomide pharmacokinetics.

Based on individual prediction of pharmacokinetic parameters using the population pharmacokinetic (PopPK) model of teriflunomide in healthy volunteers and MS patients, dose was not a significant covariate of teriflunomide pharmacokinetics.

There is a slow approach to steady-state concentration (i.e. ~100 days [3.5 months] to attain 95% of steady state concentrations, based on a median terminal half-life ( $t_{1/2z}$ ) of ~19 days calculated from the population pharmacokinetic (PopPK) analysis using data from healthy volunteers and MS patients), and the estimated AUC accumulation ratio is ~ 34-fold for 14 mg teriflunomide.

### **Distribution**

Teriflunomide is extensively bound to plasma protein (>99%), probably albumin and is mainly distributed in plasma, rather than red blood cells. The volume of distribution is low (11 L) after a single intravenous (IV) administration.

### **Metabolism**

Teriflunomide is moderately metabolised and is the only component detected in plasma. The primary biotransformation pathway for teriflunomide is hydrolysis, with oxidation being a minor pathway. Other pathways involve N-acetylation and sulfate conjugation.

### **Excretion**

Teriflunomide is excreted in the gastrointestinal tract mainly through the bile as unchanged drug and possibly by direct secretion. Teriflunomide is a substrate of the efflux transporter Breast Cancer Resistant Protein (BCRP), which could be involved in direct secretion. Over 21 days, 60.1% of the administered dose is excreted via faeces (37.5%) and also via urine (22.6%). After the accelerated elimination procedure with cholestyramine, an additional 23.1% was recovered (mostly in faeces). Based on individual prediction of pharmacokinetic parameters using the PopPK model of teriflunomide in healthy volunteers and MS patients, median terminal exponential half-life ( $t_{1/2z}$ ) was ~ 19 days after repeated doses of 14 mg. After a single IV administration, the total body clearance of teriflunomide is 30.5 mL/h. Biliary recycling is a major contributor to the long elimination half-life of teriflunomide. After a single IV administration, the total body clearance of teriflunomide is 30.5 mL/h. Studies with both haemodialysis and CAPD (chronic ambulatory peritoneal dialysis) indicate that teriflunomide is not dialysable.

## ***Special populations***

### ***Gender, Elderly Paediatric patients***

Several sources of intrinsic variability were identified in healthy subjects and MS patients based on the population pharmacokinetic analysis: age, body weight, gender, race, and albumin and bilirubin levels. Nevertheless their impact remains limited ( $\leq 31\%$ ).

### ***Hepatic impairment***

Mild and moderate hepatic impairment had no impact on the pharmacokinetics of teriflunomide. Therefore no dose adjustment is anticipated in mild to moderate hepatically impaired patients. However, teriflunomide is contraindicated in patients with severe hepatic impairment (see Section 4.3 Contraindications).

### ***Renal impairment***

Severe renal impairment had no impact on the pharmacokinetics of teriflunomide. Therefore, no dose adjustment is anticipated in severe renally impaired patients.

## **5.3 PRECLINICAL SAFETY DATA**

### ***Genotoxicity***

Teriflunomide was not mutagenic in bacteria (*Salmonella typhimurium* and *Escherichia coli*) or in Chinese hamster lung cells in vitro and did not cause chromosomal damage in vivo (mouse, rat and Chinese hamster bone marrow cells). A positive effect was found in a chromosomal damage in vitro assay in human lymphocytes, but the significance of this is unclear.

4-Trifluoromethylaniline (4-TFMA), a minor metabolite of teriflunomide, was positive in assays for gene mutation (bacteria and Chinese hamster cells) and for chromosome aberration at high in vitro concentrations (Chinese hamster cells), but negative in the unscheduled DNA synthesis test and it was not clastogenic in vivo in mice (micronucleus test) and Chinese hamsters (chromosome aberration test).

### ***Carcinogenicity***

No evidence of carcinogenicity was observed in a 2 year bioassay in rats at oral doses of teriflunomide up to the maximally tolerated dose of 4 and 12 mg/kg/day respectively. Respective systemic exposures in these studies were about 30% and 3-fold the maximum human teriflunomide exposure based on plasma AUC<sub>0-24</sub>). The risk of malignancy, particularly lymphoproliferative disorders, is increased with the use of some immunosuppressant medications. There is a potential for immunosuppression with Aubagio. Large, long-term studies would be needed to determine whether there is an increased risk of malignancy or lymphoproliferative disorders with Aubagio.



## **6 PHARMACEUTICAL PARTICULARS**

### **6.1 LIST OF EXCIPIENTS**

Lactose monohydrate, maize starch, hypromellose, microcrystalline cellulose, sodium starch glycolate, and magnesium stearate.

The film coating (OPADRY complete film coating system 03F20651 BLUE) is made of hypromellose, titanium dioxide, purified talc, macrogol 8000 and indigo carmine aluminium lake.

### **6.2 INCOMPATIBILITIES**

Incompatibilities were either not assessed or not identified as part of the registration of this medicine.

### **6.3 SHELF LIFE**

In Australia, information on the shelf life can be found on the public summary of the Australian Register of Therapeutic Goods (ARTG). The expiry date can be found on the packaging.

### **6.4 SPECIAL PRECAUTIONS FOR STORAGE**

Store below 30 degrees Celsius.

### **6.5 NATURE AND CONTENTS OF CONTAINER**

Aubagio is supplied as:

84 tablets in a carton containing 3 wallets of 2 folded polyamide/aluminium/polyvinylchloride blisters of 14 tablets per blister\*.

28 tablets in a carton containing 1 wallet composed of 2 folded polyamide/aluminium/polyvinylchloride blisters of 14 tablets per blister.

14 tablets in a carton containing 1 wallet composed of 1 polyamide/aluminium/polyvinylchloride blister of 14 tablets per blister\*.

10 tablets in a carton containing 2 polyamide/aluminium/polyvinylchloride blister of 5 tablets

5 tablets in a carton containing 1 polyamide/aluminium/polyvinylchloride blister of 5 tablets\*

\* Not marketed

### **6.6 SPECIAL PRECAUTIONS FOR DISPOSAL**

In Australia, any unused medicine or waste material should be disposed of by taking to your local pharmacy.

## 6.7 PHYSICOCHEMICAL PROPERTIES

Teriflunomide, is an oral de novo pyrimidine synthesis inhibitor of the dihydroorotate dehydrogenase (DHO-DH) enzyme.

Teriflunomide is a white to almost white powder that is sparingly soluble in acetone, slightly soluble in polyethylene glycol and ethanol, very slightly soluble in isopropanol and practically insoluble in water. Teriflunomide has a pKa of 3.1 at room temperature and its aqueous solubility is pH dependent and decreases with lowering pH. Teriflunomide is Class 2 in the Biopharmaceutics Classification System.

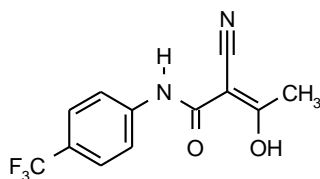
### **Chemical structure**

Chemical name: (Z)-2-Cyano-3-hydroxy-but-2-enoic acid-(4-trifluoromethylphenyl)-amide

Molecular formula: C<sub>12</sub>H<sub>9</sub>F<sub>3</sub>N<sub>2</sub>O<sub>2</sub>

Molecular weight: 270.21

The chemical structure of teriflunomide is



**CAS number:** 163451-81-8

## 7 MEDICINE SCHEDULE (POISONS STANDARD)

Prescription Only Medicine (Schedule 4)

## 8 SPONSOR

### **Australia**

sanofi-aventis australia pty ltd  
12-24 Talavera Road  
Macquarie Park NSW 2113

Toll Free Number (medical information): 1800 818 806

E-mail: medinfo.australia@sanofi.com

### **New Zealand**

sanofi-aventis new zealand limited  
Level 8, 56 Cawley Street  
Ellerslie, Auckland

Toll Free Number (medical information): 0800 283 684  
Email: medinfo.australia@sanofi.com

## **9 DATE OF FIRST APPROVAL**

14 November 2012

## **10 DATE OF REVISION**

12 February 2021

### **SUMMARY TABLE OF CHANGES**

<b>Section Changed</b>	<b>Summary of new information</b>
4.8	Addition of nail disorders and colitis to the Post-Marketing Experience section