

Attachment 1: Product information for AusPAR Vytorin Ezetimibe/Simvastatin Merck Sharp and Dohme (Australia) Pty Limited PM-2011-01219-3-1 Final 28 February 2013. This Product Information was approved at the time this AusPAR was published.

## PRODUCT INFORMATION

### VYTORIN<sup>®</sup>

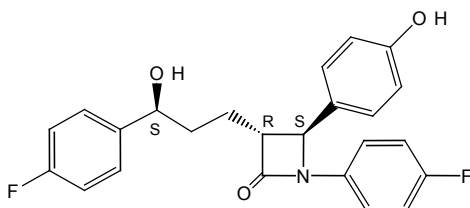
(ezetimibe and simvastatin)

### NAME OF THE MEDICINE

#### **Ezetimibe**

The chemical name of ezetimibe is 1-(4-fluorophenyl)-3(R)-[3-(4-fluorophenyl)-3(S)-hydroxypropyl]-4(S)-(4-hydroxyphenyl)-2-azetidinone. The empirical formula is C<sub>24</sub>H<sub>21</sub>F<sub>2</sub>NO<sub>3</sub> and its molecular weight is 409.4. The CAS registry number for Ezetimibe is CAS-163222-33-1.

Ezetimibe is a white, crystalline powder that is freely to very soluble in ethanol, methanol, and acetone and practically insoluble in water. Its structural formula is:

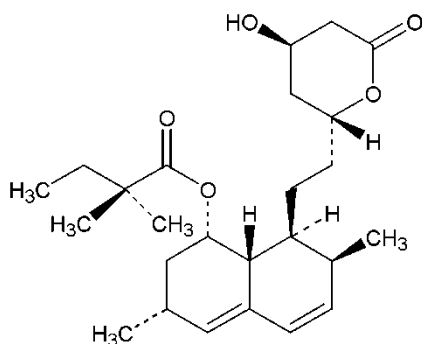


#### **Simvastatin**

Simvastatin, an inactive lactone, is hydrolysed to the corresponding  $\beta$ -hydroxyacid form, which is an inhibitor of HMG-CoA reductase. Simvastatin is butanoic acid, 2,2-dimethyl-, 1,2,3,7,8,8a-hexahydro-3,7-dimethyl-8-[2-(tetrahydro-4-hydroxy-6-oxo-2H-pyran-2-yl)-ethyl]-1-naphthalenyl ester, [1S-[1 $\alpha$ ,3 $\alpha$ ,7 $\beta$ ,8 $\beta$ (2S\*,4S\*),-8a $\beta$ ]]. The empirical formula of simvastatin is C<sub>25</sub>H<sub>38</sub>O<sub>5</sub> and its molecular weight is 418.57. The CAS registry number for simvastatin is CAS-79902-63-9.

Simvastatin is a white to off-white, non-hygroscopic, crystalline powder that is practically insoluble in water, and freely soluble in chloroform, methanol and ethanol. Its structural formula is:

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## DESCRIPTION

VYTORIN (ezetimibe/simvastatin) is a lipid-lowering product that selectively inhibits the intestinal absorption of cholesterol and related plant sterols and inhibits the endogenous synthesis of cholesterol.

VYTORIN is available for oral use as tablets containing 10 mg of ezetimibe, and 10 mg of simvastatin (VYTORIN 10/10), 20 mg of simvastatin (VYTORIN 10/20), 40 mg of simvastatin (VYTORIN 10/40), or 80 mg of simvastatin (VYTORIN 10/80).

Each tablet contains the following inactive ingredients: butylated hydroxyanisole, citric acid monohydrate, croscarmellose sodium, hypromellose, lactose, magnesium stearate, microcrystalline cellulose, and propyl gallate.

## PHARMACOLOGY

### Mechanism of Action

#### VYTORIN

Plasma cholesterol homeostasis depends on the balance between intestinal absorption and endogenous synthesis. VYTORIN contains ezetimibe and simvastatin, two lipid-lowering compounds with complementary mechanisms of action. VYTORIN reduces elevated total-C, LDL-C, Apo B, TG, and non-HDL-C, and increases HDL-C through dual inhibition of cholesterol absorption and synthesis.

#### Ezetimibe

Ezetimibe inhibits the intestinal absorption of cholesterol. Ezetimibe is orally active and has a mechanism of action that differs from other classes of cholesterol-reducing compounds (e.g., statins, bile acid sequestrants [resins], fibric acid derivatives, and plant stanols). The molecular

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target of ezetimibe is the sterol transporter, Niemann-Pick C1-Like 1 (NPC1L1), which is responsible for the intestinal uptake of cholesterol and phytosterols.

Ezetimibe localises at the brush border of the small intestine and inhibits the absorption of cholesterol, leading to a decrease in the delivery of intestinal cholesterol to the liver; statins reduce cholesterol synthesis in the liver and together these distinct mechanisms provide complementary cholesterol reduction.

In a 2-week clinical study in 18 hypercholesterolaemic patients, ezetimibe inhibited intestinal cholesterol absorption by 54%, compared with placebo.

A series of preclinical studies was performed to determine the selectivity of ezetimibe for inhibiting cholesterol absorption. Ezetimibe inhibited the absorption of [<sup>14</sup>C]-cholesterol with no effect on the absorption of triglycerides, fatty acids, bile acids, progesterone, ethinyl estradiol, or the fat-soluble vitamins A and D.

#### Simvastatin

After oral ingestion, simvastatin, which is an inactive lactone, is hydrolysed in the liver to the corresponding active  $\beta$ -hydroxyacid form which has a potent activity in inhibiting HMG-CoA reductase (3 hydroxy - 3 methylglutaryl CoA reductase). This enzyme catalyses the conversion of HMG-CoA to mevalonate, an early and rate-limiting step in the biosynthesis of cholesterol.

Simvastatin has been shown to reduce both normal and elevated LDL-C concentrations. LDL is formed from very-low-density protein (VLDL) and is catabolised predominantly by the high affinity LDL receptor. The mechanism of the LDL-lowering effect of simvastatin may involve both reduction of VLDL-cholesterol (VLDL-C) concentration and induction of the LDL receptor, leading to reduced production and increased catabolism of LDL-C. Apolipoprotein B also falls substantially during treatment with simvastatin. In addition, simvastatin moderately increases HDL-C and reduces plasma TG. As a result of these changes, the ratios of total- to HDL-C and LDL- to HDL-C are reduced.

#### Pharmacokinetics

##### Ezetimibe

##### Absorption

After oral administration, ezetimibe is rapidly absorbed and extensively conjugated to a pharmacologically active phenolic glucuronide (ezetimibe-glucuronide). Mean maximum plasma concentrations ( $C_{max}$ ) occur within 1 to 2 hours for ezetimibe-glucuronide and 4 to 12 hours for ezetimibe. The absolute bioavailability of ezetimibe cannot be determined as the compound is virtually insoluble in aqueous media suitable for injection.

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Concomitant food administration (high fat or non-fat meals) had no effect on the oral bioavailability of ezetimibe when administered as ezetimibe 10-mg tablets.

#### Distribution

Ezetimibe and ezetimibe-glucuronide are bound 99.7% and 88 to 92% to human plasma proteins, respectively.

#### Metabolism

Ezetimibe is metabolised primarily in the small intestine and liver via glucuronide conjugation (a phase II reaction) with subsequent biliary excretion. Minimal oxidative metabolism (a phase I reaction) has been observed in all species evaluated. Ezetimibe and ezetimibe-glucuronide are the major drug-derived compounds detected in plasma, constituting approximately 10 to 20% and 80 to 90% of the total drug in plasma, respectively. Both ezetimibe and ezetimibe-glucuronide are slowly eliminated from plasma with evidence of significant enterohepatic recycling. The half-life for ezetimibe and ezetimibe-glucuronide is approximately 22 hours.

#### Excretion

Following oral administration of <sup>14</sup>C-ezetimibe (20 mg) to human subjects, total ezetimibe accounted for approximately 93% of the total radioactivity in plasma. Approximately 78% and 11% of the administered radioactivity were recovered in the faeces and urine, respectively, over a 10-day collection period. After 48 hours, there were no detectable levels of radioactivity in the plasma.

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## Simvastatin

### Absorption

The availability of the  $\beta$ -hydroxyacid to the systemic circulation following an oral dose of simvastatin was found to be less than 5% of the dose, consistent with extensive hepatic first-pass extraction. The major metabolites of simvastatin present in human plasma are the  $\beta$ -hydroxyacid and four additional active metabolites.

Relative to the fasting state, the plasma profiles of both active and total inhibitors were not affected when simvastatin was administered immediately before a test meal.

### Distribution

Both simvastatin and the  $\beta$ -hydroxyacid are bound to human plasma proteins (95%).

The pharmacokinetics of single and multiple doses of simvastatin showed that no accumulation of drug occurred after multiple dosing. In all of the above pharmacokinetic studies, the maximum plasma concentration of inhibitors occurred 1.3 to 2.4 hours post-dose.

### Metabolism

Simvastatin is an inactive lactone which is readily hydrolysed *in vivo* to the corresponding  $\beta$ -hydroxyacid, a potent inhibitor of HMG-CoA reductase. Hydrolysis takes place mainly in the liver; the rate of hydrolysis in human plasma is very slow.

In man simvastatin is well absorbed and undergoes extensive hepatic first-pass extraction. The extraction in the liver is dependent on the hepatic blood flow. The liver is its primary site of action, with subsequent excretion of drug equivalents in the bile. Consequently, availability of active drug to the systemic circulation is low.

Following an intravenous injection of the  $\beta$ -hydroxyacid metabolite, its half-life averaged 1.9 hours.

In dose proportionality studies utilising doses of simvastatin of 5 mg, 10 mg, 20 mg, 60 mg, 90 mg and 120 mg there was no substantial deviation from linearity of AUC of inhibitors in the general circulation with an increase in dose.

### Excretion

Following an oral dose of radioactive simvastatin to man, 13% of the radioactivity was excreted in the urine and 60% in the faeces within 96 hours. The amount recovered in the faeces represents absorbed drug equivalents excreted in bile as well as unabsorbed drug. Following an

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intravenous injection of the  $\beta$ -hydroxyacid metabolite an average of only 0.3% of the IV dose was excreted in urine as inhibitors.

## Characteristics in Special Populations

### Paediatric Patients

#### Ezetimibe

The absorption and metabolism of ezetimibe are similar between children and adolescents (10 to 18 years) and adults. Based on total ezetimibe, there are no pharmacokinetic differences between adolescents and adults. Pharmacokinetic data in the paediatric population < 10 years of age are not available. Clinical experience in paediatric and adolescent patients (ages 9 to 17) has been limited to patients with HoFH or homozygous sitosterolaemia. (see **PRECAUTIONS**).

### Elderly Patients

#### Ezetimibe

Plasma concentrations for total ezetimibe are about 2-fold higher in the elderly ( $\geq 65$  years) than in the young (18 to 45 years). LDL-C reduction and safety profile are comparable between elderly and young subjects treated with ezetimibe (see **PRECAUTIONS**).

### Hepatic Insufficiency

#### Ezetimibe

After a single 10-mg dose of ezetimibe, the mean area under the curve (AUC) for total ezetimibe was increased approximately 1.7-fold in patients with mild hepatic insufficiency (Child-Pugh score 5 or 6), compared to healthy subjects. In a 14-day, multiple-dose study (10 mg daily) in patients with moderate hepatic insufficiency (Child-Pugh score 7 to 9), the mean AUC for total ezetimibe was increased approximately 4-fold on Day 1 and Day 14 compared to healthy subjects. No dosage adjustment is necessary for patients with mild hepatic insufficiency. Due to the unknown effects of the increased exposure to ezetimibe in patients with moderate or severe (Child-Pugh score > 9) hepatic insufficiency, ezetimibe is not recommended in these patients (see **PRECAUTIONS**).

### Renal Insufficiency

#### Ezetimibe

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After a single 10-mg dose of ezetimibe in patients with severe renal disease (n=8; mean CrCl  $\leq$  30 mL/min/1.73 m<sup>2</sup>), the mean AUC for total ezetimibe was increased approximately 1.5-fold, compared to healthy subjects (n=9).

An additional patient in this study (post-renal transplant and receiving multiple medications, including cyclosporin) had a 12-fold greater exposure to total ezetimibe.

#### Simvastatin

In a study of patients with severe renal insufficiency (creatinine clearance < 30 mL/min), the plasma concentrations of total inhibitors after a single dose of a related HMG-CoA reductase inhibitor were approximately two-fold higher than those in healthy volunteers.

#### Gender

Plasma concentrations for total ezetimibe are slightly higher (<20%) in women than in men. LDL-C reduction and safety profile are comparable between men and women treated with ezetimibe.

#### Race

Based on a meta-analysis of pharmacokinetic studies with ezetimibe, there were no pharmacokinetic differences between Blacks and Caucasians.

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## CLINICAL TRIALS

Five multicenter, double-blind studies conducted with VYTORIN in patients with primary hypercholesterolaemia are reported: two were comparisons with simvastatin and two were comparisons with atorvastatin and one was a comparison with rosuvastatin.

In controlled clinical studies, VYTORIN significantly reduced total cholesterol (total-C), low-density lipoprotein cholesterol (LDL-C), apolipoprotein B (Apo B), triglycerides (TG), and non-high-density lipoprotein cholesterol (non-HDL-C), and increased high-density lipoprotein cholesterol (HDL-C) in patients with hypercholesterolaemia.

### Primary Hypercholesterolaemia

#### VYTORIN

In a multicenter, double-blind, placebo-controlled, 12-week trial, 887 hypercholesterolaemic patients were randomised to one of ten treatment groups: placebo, ezetimibe (10 mg), simvastatin (10 mg, 20 mg, 40 mg, or 80 mg), or co-administered ezetimibe and simvastatin equivalent to VYTORIN (10/10, 10/20, 10/40, and 10/80). VYTORIN significantly lowered total-C, LDL-C, Apo B, TG, non-HDL-C, and C-reactive protein compared to all doses of simvastatin. The effects of VYTORIN on HDL-C were similar to the effects seen with simvastatin. Further analysis showed VYTORIN significantly increased HDL-C compared with placebo. (See Tables 1 [mean absolute change] and 1a [mean percent change].)



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Table 1  
Response to VYTORIN in Patients with Primary Hypercholesterolaemia  
(Mean<sup>a</sup> Absolute Change from Untreated Baseline<sup>b</sup>)

Treatment		Total-C	LDL-C	Apo B	HDL-C	TG <sup>a</sup>	Non-HDL-C
		Abs†	Abs†	Abs†	Abs†	Abs†	Abs†
(Daily Dose)	N	[Baseline]	[Baseline]	[Baseline]	[Baseline]	[Baseline]	[Baseline]
Pooled data (All VYTORIN doses)	353	-2.55 [6.73]	-2.42 [4.52]	-0.68 [1.60]	+0.10 [1.31]	-0.48 [1.90]	-2.65 [5.42]
Pooled data (All simvastatin doses)	349	-1.78 [6.70]	-1.75 [4.52]	-0.47 [1.59]	+0.09 [1.28]	-0.26 [1.89]	-1.87 [5.42]
Ezetimibe 10 mg	92	-0.94 [6.79]	-0.91 [4.55]	-0.23 [1.58]	+0.08 [1.32]	-0.21 [1.85]	-1.02 [5.46]
Placebo	93	+0.13 [6.66]	+0.11 [4.49]	+0.04 [1.59]	+0.02 [1.30]	-0.03 [1.83]	+0.11 [5.36]
VYTORIN by dose							
10/10	87	-2.13 [6.70]	-2.09 [4.49]	-0.59 [1.62]	+0.11 [1.31]	-0.39 [1.87]	-2.24 [5.39]
10/20	86						

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		-2.52	-2.35	-0.69	+0.09	-0.53	-2.62
		[6.88]	[4.63]	[1.63]	[1.33]	[2.00]	[5.55]
10/40	89	-2.69	-2.47	-0.72	+0.10	-0.56	-2.79
		[6.71]	[4.45]	[1.60]	[1.31]	[1.93]	[5.40]
10/80	91	-2.88	-2.76	-0.74	+0.08	-0.46	-2.95
		[6.64]	[4.50]	[1.57]	[1.29]	[1.81]	[5.35]
Simvastatin by dose							
10 mg	81	-1.41	-1.44	-0.38	+0.05	-0.8	-1.47
		[6.69]	[4.53]	[1.59]	[1.30]	[1.82]	[5.39]
20 mg	90	-1.61	-1.58	-0.41	+0.07	-0.25	-1.68
		[6.66]	[4.49]	[1.58]	[1.29]	[1.85]	[5.38]
40 mg	91	-1.95	-1.90	-0.55	+0.10	-0.33	-2.04
		[6.71]	[4.55]	[1.61]	[1.25]	[1.90]	[5.47]
80 mg	87	-2.16	-2.09	-0.57	+0.13	-0.43	-2.29
		[6.72]	[4.52]	[1.59]	[1.28]	[1.94]	[5.44]

<sup>†</sup> Mean absolute change from baseline (units are mmol/L for all parameters except Apo B, which is in g/L)

<sup>a</sup> For triglycerides, median absolute change from baseline

<sup>b</sup> Baseline - on no lipid-lowering drug

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Table 1a  
 Response to VYTORIN in Patients with Primary Hypercholesterolaemia  
 (Mean<sup>a</sup> Percent Change from Untreated Baseline<sup>b</sup>)

Treatment  (Daily Dose)	N	Total-C	LDL-C	Apo B	HDL-C	TG <sup>a</sup>	Non-HDL-C
		Pct† [Baseline‡]	Pct† [Baseline‡]	Pct† [Baseline‡]	Pct† [Baseline‡]	Pct† [Baseline‡]	Pct† [Baseline‡]
Pooled data (All VYTORIN doses) <sup>c</sup>	353	-38 [6.73]	-53 [4.52]	-42 [1.60]	+8 [1.31]	-28 [1.90]	-49 [5.42]
Pooled data (All simvastatin doses) <sup>c</sup>	349	-26 [6.70]	-38 [4.52]	-29 [1.59]	+8 [1.28]	-15 [1.89]	-34 [5.42]
Ezetimibe 10 mg	92	-14 [6.79]	-20 [4.55]	-15 [1.58]	+7 [1.32]	-13 [1.85]	-19 [5.46]
Placebo	93	+2 [6.66]	+3 [4.49]	+3 [1.59]	+2 [1.30]	-2 [1.83]	+2 [5.36]
VYTORIN by dose							
10/10	87	-32 [6.70]	-46 [4.49]	-36 [1.62]	+9 [1.31]	-21 [1.87]	-41 [5.39]
10/20	86	-37	-51	-41	+8	-31	-47

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		[6.88]	[4.63]	[1.63]	[1.33]	[2.00]	[5.55]
10/40	89	-39	-55	-44	+9	-32	-51
		[6.71]	[4.45]	[1.60]	[1.31]	[1.93]	[5.40]
10/80	91	-43	-61	-47	+6	-28	-55
		[6.64]	[4.50]	[1.57]	[1.29]	[1.81]	[5.35]
Simvastatin by dose							
10 mg	81	-21	-31	-23	+5	-4	-27
		[6.69]	[4.53]	[1.59]	[1.30]	[1.82]	[5.39]
20 mg	90	-24	-35	-25	+6	-14	-31
		[6.66]	[4.49]	[1.58]	[1.29]	[1.85]	[5.38]
40 mg	91	-29	-42	-33	+8	-19	-37
		[6.71]	[4.55]	[1.61]	[1.25]	[1.90]	[5.47]
80 mg	87	-32	-46	-35	+11	-26	-41
		[6.72]	[4.52]	[1.59]	[1.28]	[1.94]	[5.44]

<sup>†</sup> Mean percent change from baseline

<sup>‡</sup> Baseline units are mmol/L for all parameters except Apo B, which is in g/L

<sup>a</sup> For triglycerides, median % change from baseline

<sup>b</sup> Baseline - on no lipid-lowering drug

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<sup>c</sup> VYTORIN doses pooled (10/10-10/80) significantly reduced total-C, LDL-C, Apo B, TG, and non-HDL-C compared to simvastatin, and significantly increased HDL-C compared to placebo.

In a similarly designed study, results for all lipid parameters were generally consistent. In a pooled analysis of these two studies, the incremental reduction of LDL-C concentration with the combination tablet was generally consistent across subgroups tested, including risk factor status, age, and baseline lipid profile. In addition, the lipid response to VYTORIN was similar in patients with TG levels greater than or less than 2.3 mmol/L (200 mg/dL).

In a multicenter, double-blind, controlled, 23-week study, 710 patients with known CHD or CHD risk equivalents, as defined by the NCEP ATP III guidelines, and an LDL-C  $\geq$  3.4 mmol/L (130 mg/dL) were randomised to one of four treatment groups: co-administered ezetimibe and simvastatin equivalent to VYTORIN (10/10, 10/20, and 10/40), or simvastatin 20 mg. Patients not reaching an LDL-C < 2.6 mmol/L (100 mg/dL) had their simvastatin dose titrated at 6-week intervals to a maximal dose of 80 mg. At Week 5, the LDL-C reductions with VYTORIN 10/10, 10/20, or 10/40 were significantly larger than with simvastatin 20 mg. In addition, at Week 5, significantly more patients receiving VYTORIN 10/10, 10/20, or 10/40 attained LDL-C target compared to those receiving simvastatin 20 mg (see Tables 2 [mean absolute change] and 2a [mean percent change]). Week 5 results for LDL-C reduction and percentage attaining LDL-C target were consistent with the end of study results (Week 23).

Table 2

Response to VYTORIN after 5 Weeks in Patients with CHD or CHD Risk Equivalents and an LDL-C  $\geq$  3.4 mmol/L (130 mg/dL)

(Mean Absolute Change from Untreated Baseline)

	Simvastatin 20 mg [Baseline]	VYTORIN 10/10 [Baseline]	VYTORIN 10/20 [Baseline]	VYTORIN 10/40 [Baseline]
N	253	251	109	97
LDL-C	-1.6	-2.0	-2.3	-2.6
Abs <sup>a</sup>	[4.49]	[4.26]	[4.33]	[4.41]

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Percent attaining LDL-C goal	46	75	83	88
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<sup>a</sup> Mean absolute change from untreated baseline, expressed as mmol/L

Table 2a

Response to VYTORIN after 5 Weeks in Patients with CHD or CHD Risk Equivalents and an LDL-C  $\geq$  3.4 mmol/L (130 mg/dL)

(Mean Percent Change from Untreated Baseline)

	Simvastatin 20 mg [Baseline <sup>†</sup> ]	VYTORIN 10/10 [Baseline <sup>†</sup> ]	VYTORIN 10/20 [Baseline <sup>†</sup> ]	VYTORIN 10/40 [Baseline <sup>†</sup> ]
N	253	251	109	97
LDL-C	-38	-47	-53	-59
Pct <sup>a</sup>	[4.49]	[4.26]	[4.33]	[4.41]
Percent attaining LDL-C goal	46	75	83	88

<sup>†</sup> Baseline values expressed as mmol/L

<sup>a</sup> Mean percent change from untreated baseline

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In a multicenter, double-blind, 6-week study, 1902 patients with primary hypercholesterolaemia, who had not met their NCEP ATP III target LDL-C goal, were randomised to one of eight treatment groups: VYTORIN (10/10, 10/20, 10/40 or 10/80) or atorvastatin (10 mg, 20 mg, 40 mg or 80 mg). When patients receiving all doses of VYTORIN were compared to those receiving all doses of atorvastatin, VYTORIN lowered total-C, LDL-C, ApoB and non-HDL-C, and increased HDL-C significantly more than atorvastatin. The effects of VYTORIN on TG were similar to the effects seen with atorvastatin (see Tables 3 [mean absolute change] and 3a [mean percent change]).

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Table 3  
 Response to VYTORIN and Atorvastatin in Patients with Primary Hypercholesterolaemia  
 (Mean<sup>a</sup> Absolute Change from Untreated Baseline<sup>b</sup>)

Treatment		Total-C	LDL-C	Apo B	HDL-C	TG <sup>a</sup>	Non-HDL-C
		Abs†	Abs†	Abs†	Abs†	Abs†	Abs†
(Daily Dose)	N	[Baseline]	[Baseline]	[Baseline]	[Baseline]	[Baseline]	[Baseline]
Pooled data (All VYTORIN doses)	951	-2.64 [6.83]	-2.46 [4.60]	-0.71 [1.65]	+0.09 [1.27]	-0.51 [1.93]	-2.73 [5.56]
Pooled data (All atorvastatin doses)	951	-2.32 [6.84]	-2.11 [4.63]	-0.63 [1.65]	+0.04 [1.26]	-0.45 [1.89]	-2.36 [5.58]
VYTORIN by dose							
10/10	238	-2.33 [6.83]	-2.17 [4.57]	-0.62 [1.65]	+0.09 [1.27]	-0.44 [1.96]	-2.41 [5.56]
10/20	238	-2.52 [6.84]	-2.36 [4.62]	-0.67 [1.64]	+0.08 [1.27]	-0.42 [1.89]	-2.60 [5.57]
10/40	238	-2.81 [6.85]	-2.64 [4.60]	-0.77 [1.66]	+0.10 [1.27]	-0.55 [1.94]	-2.91 [5.58]



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10/80	237	-2.90 [6.81]	-2.68 [4.59]	-0.80 [1.65]	+0.08 [1.27]	-0.60 [1.92]	-2.98 [5.54]
Atorvastatin by dose							
10 mg	238	-1.82 [6.77]	-1.67 [4.53]	-0.51 [1.63]	+0.07 [1.25]	-0.41 [1.93]	-1.89 [5.52]
20 mg	237	-2.23 [6.86]	-2.03 [4.61]	-0.61 [1.67]	+0.05 [1.26]	-0.46 [1.96]	-2.28 [5.60]
40 mg	237	-2.46 [6.85]	-2.25 [4.65]	-0.67 [1.64]	+0.04 [1.30]	-0.41 [1.82]	-2.49 [5.55]
80 mg	239	-2.78 [6.89]	-2.49 [4.72]	-0.74 [1.67]	+0.10 [1.24]	-0.59 [1.87]	-2.79 [5.65]

<sup>†</sup> Mean absolute change from baseline (units are mmol/L for all parameters except Apo B, which is in g/L)

<sup>a</sup> For triglycerides, median absolute change from baseline

<sup>b</sup> Baseline - on no lipid-lowering drug

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Table 3a  
 Response to VYTORIN and Atorvastatin in Patients with Primary Hypercholesterolaemia  
 (Mean<sup>a</sup> Percent Change from Untreated Baseline<sup>b</sup>)

Treatment  (Daily Dose)	N	Total-C				TG <sup>a</sup>	Non-HDL-C
		Pct† [Baseline‡]	LDL-C Pct† [Baseline‡]	Apo B Pct† [Baseline‡]	HDL-C Pct† [Baseline‡]	Pct† [Baseline‡]	Pct† [Baseline‡]
Pooled data (All VYTORIN doses)	951	-38 <sup>c</sup> [6.83]	-53 <sup>c</sup> [4.60]	-43 <sup>c</sup> [1.65]	+8 <sup>c</sup> [1.27]	-27 [1.93]	-49 <sup>c</sup> [5.56]
Pooled data (All atorvastatin doses)	951	-34 [6.84]	-45 [4.63]	-38 [1.65]	+4 [1.26]	-26 [1.89]	-42 [5.58]
VYTORIN by dose							
10/10	238	-34 <sup>d</sup> [6.83]	-47 <sup>d</sup> [4.57]	-37 <sup>d</sup> [1.65]	+8 [1.27]	-26 [1.96]	-43 <sup>d</sup> [5.56]
10/20	238	-37 <sup>d</sup> [6.84]	-51 <sup>d</sup> [4.62]	-40 <sup>d</sup> [1.64]	+7 [1.27]	-25 [1.89]	-46 <sup>d</sup> [5.57]
10/40	238	-41 <sup>d</sup> [6.85]	-57 <sup>d</sup> [4.60]	-46 <sup>d</sup> [1.66]	+9 <sup>d</sup> [1.27]	-27 [1.94]	-52 <sup>d</sup> [5.58]
10/80	237						

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		-43 <sup>d</sup>	-59 <sup>d</sup>	-48 <sup>d</sup>	+8 <sup>d</sup>	-31	-54 <sup>d</sup>
		[6.81]	[4.59]	[1.65]	[1.27]	[1.92]	[5.54]
Atorvastatin by dose							
10 mg	238	-27 [6.77]	-36 [4.53]	-31 [1.63]	+7 [1.25]	-21 [1.93]	-34 [5.52]
20 mg	237	-32 [6.86]	-44 [4.61]	-37 [1.67]	+5 [1.26]	-25 [1.96]	-41 [5.60]
40 mg	237	-36 [6.85]	-48 [4.65]	-40 [1.64]	+4 [1.30]	-24 [1.82]	-45 [5.55]
80 mg	239	-40 [6.89]	-53 [4.72]	-44 [1.67]	+1 [1.24]	-32 [1.87]	-50 [5.65]

<sup>†</sup> Mean percent change from baseline

<sup>‡</sup> Baseline units are mmol/L for all parameters except Apo B, which is in g/L

<sup>a</sup> For triglycerides, median % change from baseline

<sup>b</sup> Baseline - on no lipid-lowering drug

<sup>c</sup> p<0.05 for difference with atorvastatin

<sup>d</sup> p<0.05 for difference with atorvastatin at equal mg doses of the simvastatin component

In a multicenter, double-blind, 24-week, forced titration study, 788 patients with primary hypercholesterolaemia, who had not met their NCEP ATP III target LDL-C goal, were randomised to receive co-administered ezetimibe and simvastatin equivalent to VYTORIN (10/10 and 10/20) or atorvastatin 10 mg. For all three treatment groups, the dose of the statin was titrated at 6-week intervals to 80 mg. At each pre-specified dose comparison, VYTORIN lowered LDL-C to a greater degree than atorvastatin (see Tables 4 [mean absolute change] and 4a [mean percent change]).

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**Table 4**  
**Response to VYTORIN and Atorvastatin in Patients with Primary**  
**Hypercholesterolaemia**  
**(Mean<sup>a</sup> Absolute Change from Untreated Baseline<sup>b</sup>)**

Treatment	N	Total C Abs† [Baseline]	LDL-C Abs† [Baseline]	Apo B Abs† [Baseline]	HDL-C Abs† [Baseline]	TG <sup>a</sup> Abs† [Baseline]	Non-HDL-C Abs† [Baseline]
Week 6							
Atorvastatin 10 mg <sup>c</sup>	262	-1.95 [6.90]	-1.75 [4.67]	-0.54 [1.70]	+0.05 [1.21]	-0.42 [1.94]	-2.00 [5.68]
VYTORIN 10/10 <sup>d</sup>	263	-2.34 [6.87]	-2.15 [4.65]	-0.65 [1.72]	+0.08 [1.21]	-0.52 [1.97]	-2.42 [5.66]
VYTORIN 10/20 <sup>e</sup>	263	-2.48 [6.83]	-2.33 [4.63]	-0.70 [1.69]	+0.11 [1.21]	-0.46 [1.99]	-2.59 [5.62]
Week 12							
Atorvastatin 20 mg	246	-2.29 [6.89]	-2.06 [4.66]	-0.64 [1.69]	+0.07 [1.20]	-0.52 [1.95]	-2.36 [5.68]
VYTORIN 10/20	250	-2.52 [6.86]	-2.35 [4.65]	-0.07 [1.71]	+0.10 [1.21]	-0.52 [1.95]	-2.62 [5.65]
VYTORIN 10/40	252	-2.69 [6.83]	-2.52 [4.64]	-0.76 [1.69]	+0.14 [1.21]	-0.54 [1.98]	-2.83 [5.62]
Week 18							
Atorvastatin 40 mg	237	-2.56 [6.88]	-2.28 [4.64]	-0.72 [1.69]	+0.08 [1.21]	-0.59 [1.95]	-2.64 [5.67]
VYTORIN 10/40 <sup>f</sup>	482	-2.78 [6.84]	-2.58 [4.64]	-0.77 [1.70]	+0.12 [1.21]	-0.60 [1.97]	-2.90 [5.63]
Week 24							
Atorvastatin 80 mg	228	-2.79 [6.88]	-2.45 [4.64]	-0.76 [1.69]	+0.07 [1.21]	-0.66 [1.95]	-2.85 [5.68]
VYTORIN 10/80 <sup>f</sup>	459	-2.97 [6.84]	-2.75 [4.64]	-0.83 [1.70]	+0.14 [1.21]	-0.68 [1.97]	-3.11 [5.63]

† Mean absolute change from baseline (units are mmol/L for all parameters except Apo B, which is in g/L)

<sup>a</sup> For triglycerides, median absolute change from baseline

<sup>b</sup> Baseline - on no lipid-lowering drug

<sup>c</sup> Atorvastatin: 10 mg start dose titrated to 20 mg, 40 mg, and 80 mg through Weeks 6, 12, 18, and 24

<sup>d</sup> VYTORIN 10/10 start dose titrated to 10/20, 10/40, and 10/80 through Weeks 6, 12, 18, and 24

<sup>e</sup> VYTORIN 10/20 start dose titrated to 10/40, 10/40, and 10/80 through Weeks 6, 12, 18, and 24

<sup>f</sup> Data pooled for common doses of VYTORIN at Weeks 18 and 24.

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**Table 4a**  
**Response to VYTORIN and Atorvastatin in Patients with Primary Hypercholesterolaemia (Mean<sup>a</sup> Percent Change from Untreated Baseline<sup>b</sup>)**

Treatment	N	Total C Pct† [Baseline‡]	LDL-C Pct† [Baseline‡]	Apo B Pct† [Baseline‡]	HDL-C Pct† [Baseline‡]	TG <sup>g</sup> Pct† [Baseline‡]	Non-HDL-C Pct† [Baseline‡]
<b>Week 6</b>							
Atorvastatin 10 mg <sup>c</sup>	262	-28 [6.90]	-37 [4.67]	-32 [1.70]	+5 [1.21]	-23 [1.94]	-35 [5.68]
VYTORIN 10/10 <sup>d</sup>	263	-34 <sup>f</sup> [6.87]	-46 <sup>f</sup> [4.65]	-38 <sup>f</sup> [1.72]	+8 <sup>f</sup> [1.21]	-26 [1.97]	-43 <sup>f</sup> [5.66]
VYTORIN 10/20 <sup>e</sup>	263	-36 <sup>f</sup> [6.83]	-50 <sup>f</sup> [4.63]	-41 <sup>f</sup> [1.69]	+10 <sup>f</sup> [1.21]	-25 [1.99]	-46 <sup>f</sup> [5.62]
<b>Week 12</b>							
Atorvastatin 20 mg	246	-33 [6.89]	-44 [4.66]	-38 [1.69]	+7 [1.20]	-28 [1.95]	-42 [5.68]
VYTORIN 10/20	250	-37 <sup>f</sup> [6.86]	-50 <sup>f</sup> [4.65]	-41 <sup>f</sup> [1.71]	+9 [1.21]	-28 [1.95]	-46 <sup>f</sup> [5.65]
VYTORIN 10/40	252	-39 <sup>f</sup> [6.83]	-54 <sup>f</sup> [4.64]	-45 <sup>f</sup> [1.69]	+12 <sup>f</sup> [1.21]	-31 [1.98]	-50 <sup>f</sup> [5.62]
<b>Week 18</b>							
Atorvastatin 40 mg	237	-37 [6.88]	-49 [4.64]	-42 [1.69]	+8 [1.21]	-31 [1.95]	-47 [5.67]
VYTORIN 10/40 <sup>e</sup>	482	-40 <sup>f</sup> [6.84]	-56 <sup>f</sup> [4.64]	-45 <sup>f</sup> [1.70]	+11 <sup>f</sup> [1.21]	-32 [1.97]	-52 <sup>f</sup> [5.63]
<b>Week 24</b>							
Atorvastatin 80 mg	228	-40 [6.88]	-53 [4.64]	-45 [1.69]	+6 [1.21]	-35 [1.95]	-50 [5.68]
VYTORIN 10/80 <sup>e</sup>	459	-43 <sup>f</sup> [6.84]	-59 <sup>f</sup> [4.64]	-49 <sup>f</sup> [1.70]	+12 <sup>f</sup> [1.21]	-35 [1.97]	-55 <sup>f</sup> [5.63]

† Mean percent change from baseline

‡ Baseline values expressed as mmol/L except Apo B, which is in g/L

<sup>a</sup> For triglycerides, median % change from baseline

<sup>b</sup> Baseline - on no lipid-lowering drug

<sup>c</sup> Atorvastatin: 10 mg start dose titrated to 20 mg, 40 mg, and 80 mg through Weeks 6, 12, 18, and 24

<sup>d</sup> VYTORIN 10/10 start dose titrated to 10/20, 10/40, and 10/80 through Weeks 6, 12, 18, and 24

<sup>e</sup> VYTORIN 10/20 start dose titrated to 10/40, 10/40, and 10/80 through Weeks 6, 12, 18, and 24

<sup>f</sup> p<0.05 for difference with atorvastatin in the specified week

<sup>g</sup> Data pooled for common doses of VYTORIN at Weeks 18 and 24.

In a multicentre, double-blind, 6-week study, 2959 patients with hypercholesterolaemia, who had not met their NCEP ATP III target LDL-C goal, were randomised to one of six treatment groups: VYTORIN (10/20, 10/40 or 10/80) or rosuvastatin (10 mg, 20 mg or 40 mg). When patients receiving all doses of VYTORIN were compared to those receiving all doses of rosuvastatin, VYTORIN lowered total-C, LDL-C, Apo B and non-HDL-C significantly more than rosuvastatin. The effects of VYTORIN on HDL-C were similar to the effects seen with rosuvastatin. (see Tables 5 [mean absolute change] and 5a [mean percent change]).

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**Table 5**  
**Response to VYTORIN and Rosuvastatin in Patients with Primary**  
**Hypercholesterolaemia**  
**Modified-Intention-To-Treat Approach**  
**(Mean<sup>a</sup> Absolute Change from Untreated Baseline<sup>b</sup>)**

Treatment		Total-C	LDL-C	Apo B	HDL-C	TG <sup>a</sup>	Non-HDL-C
(Daily Dose)	N	Abs† [Baseline‡]	Abs† [Baseline‡]	Abs† [Baseline‡]	Abs† [Baseline‡]	Abs† [Baseline‡]	Abs† [Baseline‡]
Pooled data (All VYTORIN doses)	1427	-2.71 <sup>c</sup> [6.65]	-2.55 <sup>c</sup> [4.47]	-0.73 <sup>c</sup> [1.58]	+0.09 [1.30]	-0.42 [1.77]	-2.80 <sup>c</sup> [5.35]
Pooled data (All rosuvastatin doses)	1428	-2.50 [6.66]	-2.37 [4.48]	-0.69 [1.59]	+0.09 [1.29]	-0.42 [1.80]	-2.59 [5.36]
VYTORIN by dose							
10/20	476	-2.47 <sup>d</sup> [6.62]	-2.35 <sup>d</sup> [4.46]	-0.67 <sup>d</sup> [1.58]	+0.08 [1.31]	-0.35 [1.70]	-2.55 <sup>d</sup> [5.32]
10/40	477	-2.68 <sup>e</sup> [6.69]	-2.52 <sup>e</sup> [4.48]	-0.73 <sup>e</sup> [1.59]	+0.10 [1.30]	-0.45 [1.85]	-2.78 <sup>e</sup> [5.38]
10/80	474	-2.97 <sup>f</sup> [6.63]	-2.78 <sup>f</sup> [4.47]	-0.80 <sup>f</sup> [1.58]	+0.09 [1.30]	-0.50 <sup>f</sup> [1.76]	-3.06 <sup>f</sup> [5.34]
Rosuvastatin by dose							
10 mg	475	-2.21 [6.65]	-2.11 [4.45]	-0.61 [1.58]	+0.08 [1.31]	-0.33 [1.83]	-2.29 [5.34]
20 mg	478	-2.53 [6.66]	-2.39 [4.48]	-0.70 [1.59]	+0.10 [1.29]	-0.44 [1.80]	-2.63 [5.37]
40 mg	475	-2.75 [6.66]	-2.61 [4.50]	-0.76 [1.59]	+0.10 [1.29]	-0.46 [1.75]	-2.85 [5.37]

† Mean absolute change from baseline

‡ Baseline values expressed as mmol/L except Apo B, which is in g/L

<sup>a</sup> For triglycerides, median absolute change from baseline

<sup>b</sup> Baseline - on no lipid-lowering drug

<sup>c</sup> p<0.05 for difference with rosuvastatin

<sup>d</sup> p<0.05 vs. rosuvastatin 10 mg

<sup>e</sup> p<0.05 vs. rosuvastatin 20 mg

<sup>f</sup> p<0.05 vs. rosuvastatin 40 mg

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**Table 5a**  
**Response to VYTORIN and Rosuvastatin in Patients with Primary**  
**Hypercholesterolaemia**  
**Modified-Intention-To-Treat Approach**  
**(Mean<sup>a</sup> % Change from Untreated Baseline<sup>b</sup>)**

Treatment (Daily Dose)	N	Total-C Pct† [Baseline‡]	LDL-C Pct† [Baseline‡]	Apo B Pct† [Baseline‡]	HDL-C Pct† [Baseline‡]	TG <sup>a</sup> Pct† [Baseline‡]	Non-HDL-C Pct† [Baseline‡]
Pooled data (All VYTORIN doses)	1427	-40 <sup>c</sup> [6.65]	-56 <sup>c</sup> [4.47]	-45 <sup>c</sup> [1.58]	+8 [1.30]	-26 [1.77]	-51 <sup>c</sup> [5.35]
Pooled data (All rosuvastatin doses)	1428	-37 [6.66]	-52 [4.48]	-42 [1.59]	+8 [1.29]	-25 [1.80]	-47 [5.36]
VYTORIN by dose							
10/20	476	-37 <sup>a</sup> [6.62]	-52 <sup>c</sup> [4.46]	-42 <sup>c</sup> [1.58]	+7 [1.31]	-23 <sup>a</sup> [1.70]	-47 <sup>a</sup> [5.32]
10/40	477	-39 <sup>e</sup> [6.69]	-55 <sup>e</sup> [4.48]	-44 <sup>e</sup> [1.59]	+8 [1.30]	-27 [1.85]	-50 <sup>e</sup> [5.38]
10/80	474	-44 <sup>f</sup> [6.63]	-61 <sup>f</sup> [4.47]	-50 <sup>f</sup> [1.58]	+8 [1.30]	-30 <sup>f</sup> [1.76]	-56 <sup>f</sup> [5.34]
Rosuvastatin by dose							
10 mg	475	-32 [6.65]	-46 [4.45]	-37 [1.58]	+7 [1.31]	-20 [1.83]	-42 [5.34]
20 mg	478	-37 [6.66]	-52 [4.48]	-43 [1.59]	+8 [1.29]	-26 [1.80]	-48 [5.37]
40 mg	475	-41 [6.66]	-57 [4.50]	-47 [1.59]	+8 [1.29]	-28 [1.75]	-52 [5.37]

† Mean percent change from baseline

‡ Baseline values expressed as mmol/L except Apo B, which is in g/L

<sup>a</sup> For triglycerides, median % change from baseline

<sup>b</sup> Baseline - on no lipid-lowering drug

<sup>c</sup> p<0.05 for difference with rosuvastatin

<sup>d</sup> p<0.05 vs. rosuvastatin 10 mg

<sup>e</sup> p<0.05 vs. rosuvastatin 20 mg

<sup>f</sup> p<0.05 vs. rosuvastatin 40 mg

In a double-blind, placebo-controlled, 8-week study, 240 patients with hypercholesterolaemia already receiving simvastatin monotherapy and not at National Cholesterol Education Program (NCEP) LDL-C goal (2.6 to 4.1 mmol/L [100 to 160 mg/dL], depending on baseline characteristics) were randomised to receive either ezetimibe 10 mg or placebo in addition to their on-going simvastatin therapy. Among simvastatin-treated patients not at LDL-C goal at baseline (~80%), significantly more patients randomised to ezetimibe co-administered with simvastatin achieved their LDL-C goal at study endpoint compared to patients randomised to placebo co-administered with simvastatin, 76% and 21.5%, respectively. The additional corresponding LDL-C reductions for ezetimibe or placebo co-administered with simvastatin were also significantly different (27% or 3%, respectively). In addition, ezetimibe co-administered

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with simvastatin significantly decreased total-C, Apo B, and TG compared with placebo co-administered with simvastatin.

In a multicenter, double-blind, 24-week trial, 214 patients with type 2 diabetes mellitus treated with thiazolidinediones (rosiglitazone or pioglitazone) for a minimum of 3 months and simvastatin 20 mg for a minimum of 6 weeks with a mean LDL-C of 2.4 mmol/L (93 mg/dL), were randomised to receive either simvastatin 40 mg or the co-administered active ingredients equivalent to VYTORIN 10/20.

VYTORIN 10/20 was significantly more effective than doubling the dose of simvastatin to 40 mg in further reducing LDL-C (-21% and 0%, respectively), total-C (-14% and -1%, respectively), Apo B (-14% and -2%, respectively), and non-HDL-C (-20% and -2%, respectively) beyond the reductions observed with simvastatin 20 mg. Results for HDL-C and TG between the two treatment groups were not significantly different. Results were not affected by type of thiazolidinedione treatment.

#### ENHANCE Study

This randomised, double-blind trial recruited 720 patients with heterozygous familial hypercholesterolaemia. The primary variable was the mean change in carotid intima media thickness (cIMT) from baseline to endpoint. Patients were treated with either simvastatin alone, 80 mg daily or ezetimibe 10 mg in combination with simvastatin 80 mg once daily for up to two years. The mean cIMT increased by 0.0058mm following simvastatin and 0.0111mm following combined therapy with ezetimibe and simvastatin. The difference between treatments was not statistically significant – p-value 0.29 based on ANCOVA model. The reason for the lack of difference between treatment groups in the change in cIMT is unknown.

The combination had a significantly greater effect on lipid parameters compared with simvastatin alone. Mean LDL-cholesterol decreased by 56% following ezetimibe/simvastatin compared with 39% reduction following simvastatin alone (p <0.01, based on ANOVA model). There were statistically greater reductions in total-C, Apo B, TG, campesterol and sitosterol following ezetimibe/simvastatin. Clinical outcome was not an objective of the ENHANCE trial.

#### *Ezetimibe*

In two, multicenter, double-blind, placebo-controlled, 12-week studies in 1719 patients with primary hypercholesterolemia, ezetimibe significantly lowered total-C (13%), LDL-C (19%), Apo B (14%), and TG (8%) and increased HDL-C (3%) compared to placebo. Reduction in LDL-C was consistent across age, sex, race, and baseline LDL-C. In addition, ezetimibe had no effect on the plasma concentrations of the fat-soluble vitamins A, D, and E, had no effect on prothrombin time, and did not impair adrenocortical steroid hormone production.



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### *Simvastatin*

VYTORIN contains simvastatin. In two, large placebo-controlled clinical trials, the Scandinavian Simvastatin Survival Study (N=4,444 patients) and the Heart Protection Study (N=20,536 patients), the effects of treatment with simvastatin were assessed in patients at high risk of coronary events because of existing coronary heart disease, diabetes, peripheral vessel disease, history of stroke or other cerebrovascular disease. Simvastatin was proven to reduce: the risk of total mortality by reducing CHD deaths, the risk of non-fatal myocardial infarction and stroke, and the need for coronary and non-coronary revascularisation procedures.

No incremental benefit of VYTORIN on cardiovascular morbidity and mortality over and above that demonstrated for simvastatin has been established.

#### Homozygous Familial Hypercholesterolemia (HoFH)

A double-blind, randomised, 12-week study was performed in patients with a clinical and/or genotypic diagnosis of HoFH. Data were analysed from a subgroup of patients (n=14) receiving simvastatin 40 mg at baseline. Increasing the dose of simvastatin from 40 to 80 mg (n=5) produced a reduction of LDL-C of 13% from baseline on simvastatin 40 mg. Co-administered ezetimibe and simvastatin equivalent to VYTORIN (10/40 and 10/80 pooled, n=9), produced a reduction of LDL-C of 23% from baseline on simvastatin 40 mg. In those patients co-administered ezetimibe and simvastatin equivalent to VYTORIN (10/80, n=5), a reduction of LDL-C of 29% from baseline on simvastatin 40 mg was produced.

#### Prevention of Major Vascular Events in Chronic Kidney Disease (CKD)

The Study of Heart and Renal Protection (SHARP) was a multinational, randomised, placebo-controlled, double-blind study conducted in 9,438 patients with chronic kidney disease, a third of whom were on dialysis at baseline. Patients with a definite history of myocardial infarction (MI) or coronary revascularisation procedure, existing or planned renal transplant, recent acute uraemic emergency, evidence of active inflammatory muscle disease or creatine kinase (CK) >3xULN were excluded. For the first year, patients were randomised in a ratio of 4:4:1, respectively, to VYTORIN 10/20, placebo, or simvastatin 20 mg daily. The 1-year simvastatin arm was included to enable the comparison of VYTORIN to simvastatin alone with regard to safety and lipids. At 1 year the simvastatin-only arm was re-randomised 1:1 to VYTORIN 10/20 or placebo. A total of 4,650 patients were allocated to VYTORIN 10/20 and 4,620 to placebo, and followed for a median of 4.9 years. Patients had a mean age of 62 (ranging in age from 39 to 94.5 years old); 63% were male, 72% were Caucasian, and 23% were diabetic; and, for those not on dialysis, the median serum creatinine was 0.22 mmol/L and the mean estimated glomerular filtration rate (eGFR) was 26.5 mL/min/1.73 m<sup>2</sup>, with 94% of patients having an eGFR < 45 mL/min/1.73 m<sup>2</sup>. There were no lipid entry criteria. Mean LDL-C at baseline was 2.8 mmol/L. As of the 1-year measurement, LDL-C was reduced 26% relative to placebo by

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simvastatin 20 mg alone and 38% for VYTORIN 10/20. At the midpoint of the study (2.5 years) mean LDL-C reduction for VYTORIN relative to placebo was 32%. All lipid measurements included patients no longer taking study medication.

The SHARP protocol-specified primary comparison was an intention-to-treat analysis of "major vascular events" (MVE; defined as nonfatal MI or cardiac death, stroke, or any revascularisation procedure) in only those patients initially randomised to the VYTORIN (n=4,193) or placebo (n=4,191) groups. Secondary analyses included the same composite analysed for the full cohort randomised (at study baseline or at year 1) to VYTORIN (n=4,650) or placebo (n=4,620), as well as the components of this composite.

The primary endpoint analysis showed that VYTORIN significantly reduced the risk of MVE (749 patients with events in the placebo group vs. 639 in the VYTORIN group) with an absolute risk reduction of 2.3% (number needed to treat, 43) and a relative risk reduction of 16% (p=0.001) (see Figure 1). An analysis of major atherosclerotic events (MAE, a subset of the MVE composite that excluded non-coronary cardiac deaths and haemorrhagic stroke) showed that VYTORIN significantly reduced the risk of MAE (526 (11.3%) of 4650 patients ever allocated to VYTORIN and 619 (13.4%) of 4620 patients ever allocated to placebo), corresponding to an absolute risk reduction of 2.1% (number needed to treat, 48) and a relative risk reduction of 17% (p=0.002).

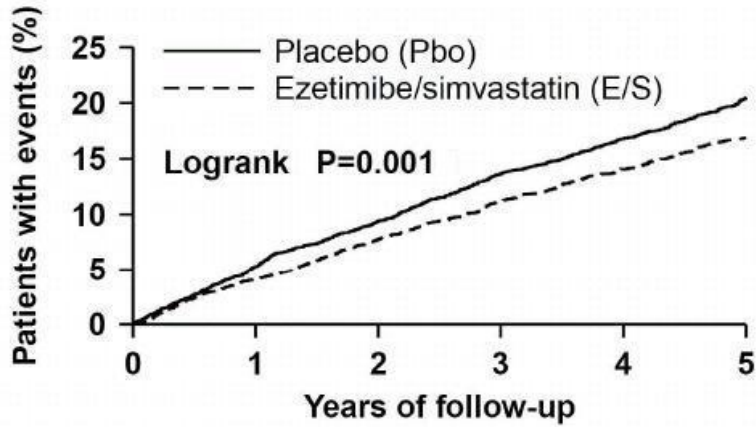
The risk reduction for the MVE composite was directionally consistent (i.e. VYTORIN numerically superior to placebo) with that of the entire cohort of patients for the following key baseline predefined subgroups: age, gender, dialysis vs. non-dialysis, eGFR, diabetes, pre-existing atherosclerotic disease, blood pressure, or tertiles of baseline LDL-C.

Compliance rates with placebo and study medication declined over the course of the study. For example, at 20-25 months of follow-up, 68% of patients allocated to ezetimibe/simvastatin and 67% of patients allocated to placebo were taking 80% or more of the study medication, while at 44-49 months, compliance had fallen to 60% and 56%, respectively.

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Figure 1: Effect of VYTORIN on the Primary Endpoint of Risk of Major Vascular Events.

**Major Vascular Events**



At risk	0	1	2	3	4	5
Pbo	4191	3807	3495	3177	2419	1239
E/S	4193	3868	3567	3273	2501	1232

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The individual components of MVE in all randomised patients are presented in Table 6. VYTORIN significantly reduced the risk of stroke and any revascularisation, with non-significant numerical differences favouring VYTORIN for nonfatal MI and cardiac death.

Table 6  
Major Vascular Events by Treatment Group in All Randomised Patients in SHARP<sup>a</sup>

Outcome	VYTORIN 10/20 (N=4,650)	Placebo (N=4,620)	Risk Ratio (95% CI)	P-value
Major Vascular Events	701 (15.1%)	814 (17.6%)	0.85 (0.77-0.94)	0.001
Nonfatal MI	134 (2.9%)	159 (3.4%)	0.84 (0.66-1.05)	0.12
Cardiac Death	253 (5.4%)	272 (5.9%)	0.93 (0.78-1.10)	0.38
Any Stroke	171 (3.7%)	210 (4.5%)	0.81 (0.66-0.99)	0.038
Non-haemorrhagic Stroke	131 (2.8%)	174 (3.8%)	0.75 (0.60-0.94)	0.011
Haemorrhagic Stroke	45 (1.0%)	37 (0.8%)	1.21 (0.78-1.86)	0.40
Any Revascularisation	284 (6.1%)	352 (7.6%)	0.79 (0.68-0.93)	0.004
Major Atherosclerotic Events (MAE) <sup>b</sup>	526 (11.3%)	619 (13.4%)	0.83 (0.74-0.94)	0.002

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<sup>a</sup> Intention-to-treat analysis on all SHARP patients randomised to VYTORIN or placebo either at baseline or year 1.

<sup>b</sup> MAE; defined as the composite of nonfatal myocardial infarction, coronary death, non-haemorrhagic stroke, or any revascularisation.

No significant treatment effect of VYTORIN on MVE was found in the subgroup of patients on dialysis at baseline compared with those not on dialysis at baseline. Among 3023 patients on dialysis at baseline, VYTORIN reduced the risk of MVE by 6% (RR 0.94: 95% CI 0.80-1.09) compared with 22% (RR 0.78: 95% CI 0.69-0.89) among 6247 patients not on dialysis at baseline (interaction P=0.08).

Among patients not on dialysis at baseline, VYTORIN did not reduce the risk of progressing to end-stage renal disease compared with placebo.

There were no significant differences between the VYTORIN and placebo groups on all cause mortality, or on any specific cause of death.

The study design precluded drawing conclusions regarding the independent contribution of either ezetimibe or simvastatin to the observed effect, and was not able to provide evidence of efficacy for the combination of VYTORIN 10/20 compared to either the lower dose combination (i.e. VYTORIN 10/10) or to treatment with statin alone (i.e. simvastatin 20 mg).

## INDICATIONS

### Primary Hypercholesterolaemia

VYTORIN is indicated as adjunctive therapy to diet in patients with primary (heterozygous familial and non-familial) hypercholesterolaemia or mixed hyperlipidaemia where use of a combination product is appropriate:

Patients not appropriately controlled with a statin or ezetimibe alone

Patients already treated with a statin and ezetimibe.

### Homozygous Familial Hypercholesterolaemia (HoFH)

VYTORIN is indicated in patients with HoFH. Patients may also receive adjunctive treatments (e.g., LDL apheresis).

## CONTRAINDICATIONS

Hypersensitivity to the active substances or to any of the excipients.

Active liver disease or unexplained persistent elevations of serum transaminases.

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Pregnancy and lactation (see PRECAUTIONS, *Use in Pregnancy and Use in Lactation*).

Myopathy secondary to other lipid lowering agents.

Concomitant administration of potent CYP3A4 inhibitors (eg. itraconazole, ketoconazole, posaconazole, HIV protease inhibitors, boceprevir, telaprevir, erythromycin, clarithromycin, telithromycin and nefazodone (see **PRECAUTIONS, Myopathy/Rhabdomyolysis, INTERACTIONS WITH OTHER MEDICINES**).

Concomitant administration of gemfibrozil, cyclosporin, or danazol (see **PRECAUTIONS, Myopathy/Rhabdomyolysis, INTERACTIONS WITH OTHER MEDICINES**).

## PRECAUTIONS

### Myopathy/Rhabdomyolysis

Simvastatin, like other inhibitors of HMG-CoA reductase, occasionally causes myopathy manifested as muscle pain, tenderness or weakness with CK above 10X the upper limit of normal (ULN). Myopathy sometimes takes the form of rhabdomyolysis with or without acute renal failure secondary to myoglobinuria, and rare fatalities have occurred. The risk of myopathy is increased by high levels of HMG-CoA reductase inhibitory activity in plasma. Predisposing factors for myopathy include advanced age ( $\geq 65$  years), female gender, uncontrolled hypothyroidism, and renal impairment.

**The risk of myopathy/rhabdomyolysis is dose related for simvastatin.** In a clinical trial database in which 41,413 patients were treated with simvastatin, 24,747 (approximately 60%) of whom were enrolled in studies with a median follow-up of at least 4 years, the incidence of myopathy was approximately 0.03%, 0.08% and 0.61% at 20, 40 and 80 mg/day, respectively. In these trials, patients were carefully monitored and some interacting medicinal products were excluded.

In a major, large, long-term clinical trial (SEARCH) in which patients with a history of myocardial infarction were treated with simvastatin 80 mg/day (mean follow up 6.7 years), the incidence of myopathy was approximately 1.0% compared with 0.02% for patients on 20 mg/day. This includes rhabdomyolysis for which the incidence was 0.1 to 0.2%, all allocated to simvastatin 80 mg/day. There is no universally accepted definition of rhabdomyolysis. In SEARCH, rhabdomyolysis was defined as a subset of myopathy with CK > 40 x ULN plus evidence of end organ damage (e.g. elevated creatinine, dark urine). Approximately half of all the myopathy cases occur during the first year of treatment. The incidence of myopathy during each subsequent year of treatment was approximately 0.1%.

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The risk of myopathy is greater in patients on simvastatin 80 mg compared with other statin-base therapies with similar LDL-C lowering efficacy. Therefore the 10/80 mg dose of VYTORIN should only be used in patients at high risk for cardiovascular complications who have not achieve their treatment goals on lower doses and when the benefits are expected to outweigh the potential risks. In patients taking VYTORIN 10/80 mg for whom an interacting agent is needed, a lower dose of VYTORIN or an alternative statin-ezetimibe regimen with less potential for drug-drug interactions should be used (see **CONTRAINDICATIONS; DOSAGE AND ADMINISTRATION**).

All patients starting therapy with VYTORIN, or whose dose of VYTORIN is being increased, should be advised of the risk of myopathy and told to report promptly any unexplained muscle pain, tenderness or weakness. VYTORIN therapy should be discontinued immediately if myopathy is diagnosed or suspected. The presence of these symptoms, and a CK level >10 times the upper limit of normal indicates myopathy. In most cases, when patients were promptly discontinued from treatment, muscle symptoms and CK increases resolved. Periodic CK determinations may be considered in patients starting therapy with VYTORIN or whose dose is being increased. Periodic CK determinations are recommended for patients titrating to the 10/80 mg dose. There is no assurance that such monitoring will prevent myopathy.

Many of the patients who have developed rhabdomyolysis on therapy with simvastatin have had complicated medical histories, including renal insufficiency usually as a consequence of long-standing diabetes mellitus. Such patients taking VYTORIN merit closer monitoring. Therapy with VYTORIN should be temporarily stopped a few days prior to elective major surgery and when any major medical or surgical condition supervenes.

In a clinical trial in which over 9,000 patients with chronic kidney disease were randomised to receive VYTORIN 10/20 mg daily (n=4,650) or placebo (n=4,620) (median follow-up 4.9 years), the incidence of myopathy/rhabdomyolysis was 0.2% for VYTORIN and 0.1% for placebo (See **ADVERSE EFFECTS**).

In an interim analysis of a large ongoing study [SEARCH] with simvastatin, 8 cases of myopathy were observed in 4283 patients who were not taking amiodarone, clarithromycin or calcium channel blockers. This represents an incidence of approximately 0.19%.

Amiodarone: During coadministration of amiodarone and simvastatin 80 mg in a large clinical trial, the risk of myopathy was about 6%. A significant interaction at lower simvastatin doses cannot be excluded.

Verapamil: Coadministration of verapamil increased the incidence of myopathy to 0.7% (with simvastatin 40 mg) or 1% (with simvastatin 80 mg).

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**Diltiazem:** Coadministration of diltiazem and simvastatin 80 mg led to a mean 70% increase in systemic exposure to simvastatin-derived HMG-CoA reductase inhibitory activity, with individual increases ranging up to 200%. In patients taking diltiazem with simvastatin 80 mg, the incidence of myopathy is about 1%.

#### Drug interactions

Because VYTORIN contains simvastatin, the risk of myopathy/rhabdomyolysis is increased by concomitant use of VYTORIN with the following medicines:

#### Contraindicated medicines

**Potent inhibitors of CYP3A4:** Concomitant use with medicines labeled as having a potent inhibitory effect on CYP3A4 at therapeutic doses (e.g., itraconazole, ketoconazole, posaconazole, erythromycin, clarithromycin, telithromycin, HIV protease inhibitors, or nefazodone) is contraindicated. If treatment with itraconazole, ketoconazole, posaconazole, erythromycin, clarithromycin, or telithromycin is unavoidable, therapy with VYTORIN should be suspended during the course of treatment (see **CONTRAINDICATIONS; INTERACTIONS WITH OTHER MEDICINES**).

**Gemfibrozil, cyclosporin or danazol:** Concomitant use of these drugs with VYTORIN is contraindicated (see **CONTRAINDICATIONS**).

#### Other medicines

**Amiodarone:** In a clinical trial, myopathy was reported in 6% of patients receiving simvastatin 80mg and amiodarone. The dose of VYTORIN should not exceed 10/20 mg daily in patients receiving concomitant medication with amiodarone (see **DOSAGE AND ADMINISTRATION; INTERACTIONS WITH OTHER MEDICINES**).

#### Calcium channel blockers:

**Verapamil or diltiazem:** Patients on diltiazem treated concomitantly with simvastatin 80mg had an increased risk of myopathy. The dose of VYTORIN should not exceed 10/20 mg daily in patients receiving concomitant medication with verapamil or diltiazem (see **DOSAGE AND ADMINISTRATION; INTERACTIONS WITH OTHER MEDICINES**).

**Amlodipine:** In a clinical trial, patients on amlodipine treated concomitantly with simvastatin 80 mg had a slightly increased risk of myopathy. The dose of VYTORIN should not exceed 10/40 mg daily in patients receiving concomitant medication with amlodipine (see **DOSAGE AND ADMINISTRATION; INTERACTIONS WITH OTHER MEDICINES**).



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**Moderate inhibitors of CYP3A4:** Patients taking other medicines labeled as having a moderate inhibitor effect on CYP3A4 concomitantly with VYTORIN, particularly higher VYTORIN doses, may have an increased risk of myopathy.

**Other Fibrates:** The safety and effectiveness of VYTORIN administered with fibrates have not been studied. Therefore, the concomitant use of VYTORIN and fibrates should be avoided. Concomitant use of gemfibrozil is contraindicated (see CONTRAINDICATIONS; INTERACTIONS WITH OTHER MEDICINES).

**Fusidic Acid:** Patients on fusidic acid treated concomitantly with VYTORIN may have an increased risk of myopathy. Patients on fusidic acid and VYTORIN should be closely monitored. Temporary suspension of VYTORIN treatment may be considered.

*Niacin ( $\geq 1$  g/day): The dose of VYTORIN should not exceed 10/20 mg daily in patients receiving concomitant medication with niacin (nicotinic acid)  $\geq 1$  g/day. Cases of myopathy/rhabdomyolysis have been observed with simvastatin co-administered with lipid-modifying doses ( $\geq 1$ g/day) of niacin. Because the incidence of myopathy observed with simvastatin co-administered with niacin  $\geq 1$ g/day is higher in Chinese than in non-Chinese patients, caution should be used when treating Chinese patients with VYTORIN co-administered with lipid-modifying doses ( $\geq 1$ g/day) of niacin or niacin containing products. Because the risk of myopathy is dose related, the use of VYTORIN 10/20 mg with lipid-modifying doses ( $\geq 1$ g/day) of niacin or niacin-containing products is not recommended in Chinese patients. It is unknown whether there is an increased risk of myopathy with co-administration in other Asian patients.*

**Anticoagulants:** If VYTORIN is added to warfarin, another coumarin anticoagulant, or fludione, the International Normalised Ratio (INR) should be appropriately monitored.

#### Liver Enzymes

In three placebo-controlled, 12-week trials, the incidence of consecutive elevations ( $\geq 3 \times$  ULN) in serum transaminases was 1.7% overall for patients treated with VYTORIN and appeared to be dose-related with an incidence of 2.6% for patients treated with VYTORIN 10/80. In controlled long-term (48-week) extensions, which included both newly-treated and previously-treated patients, the incidence of consecutive elevations ( $\geq 3 \times$  ULN) in serum transaminases was 1.8% overall and 3.6% for patients treated with VYTORIN 10/80. These elevations in transaminases were generally asymptomatic, not associated with cholestasis, and returned to baseline after discontinuation of therapy or with continued treatment.

In a controlled clinical study in which over 9,000 patients with chronic kidney disease were randomised to receive VYTORIN 10/20 mg daily (n=4,650) or placebo (n=4,620) (median follow-

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up period of 4.9 years), the incidence of consecutive elevations of transaminases (>3 X ULN) was 0.7% for VYTORIN and 0.6% for placebo (see **ADVERSE EFFECTS**).

It is recommended that LFTs be performed before treatment with VYTORIN begins and periodically thereafter when clinically indicated. Patients titrated to the 10/80mg dose should receive an additional test prior to titration, 3 months after titration to the 10/80mg dose, and periodically thereafter (e.g., semiannually) for the first year of treatment. Special attention should be paid to patients who develop elevated serum transaminase levels, and in these patients, measurements should be repeated promptly and then performed more frequently. If the transaminase levels show evidence of progression, particularly if they rise to 3 X ULN and are persistent, the drug should be discontinued. Note that ALT may emanate from muscle, therefore ALT rising with CK may indicate myopathy (see **PRECAUTIONS, Myopathy/Rhabdomyolysis**).

There have been rare post marketing reports of fatal and non-fatal hepatic failure in patients taking statins, including simvastatin. If serious liver injury with clinical symptoms and/or hyperbilirubinaemia or jaundice occurs during treatment with VYTORIN, promptly interrupt therapy. If an alternate etiology is not found do not restart VYTORIN.

VYTORIN should be used with caution in patients who consume substantial quantities of alcohol and/or have a past history of liver disease. Active liver diseases or unexplained persistent transaminase elevations are contraindications to the use of VYTORIN.

#### Hepatic Insufficiency

Due to the unknown effects of the increased exposure to ezetimibe in patients with moderate or severe hepatic insufficiency, VYTORIN is not recommended in these patients (see *Characteristics in Special Populations*).

#### *Carcinogenicity*

#### *VYTORIN*

*Carcinogenicity studies with ezetimibe/simvastatin combinations have not been performed.*

#### *Ezetimibe*

Two-year dietary studies with ezetimibe alone in mice and rats showed no evidence of carcinogenic potential. The highest ezetimibe dose (500 mg/kg/day) in mice corresponds to exposure levels approximately 4 and  $\geq$  150 times the adult human exposure for ezetimibe and total ezetimibe, respectively, based on AUC. Exposures in rats at the highest dose (1500 mg/kg/day in males and 500 mg/kg/day in females)

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correspond to approximately 2 and 14 times the adult human exposure for ezetimibe and total ezetimibe, respectively.

#### *Simvastatin*

Carcinogenicity studies have been conducted in mice at oral doses ranging from 1 to 400 mg/kg/day and in rats at doses of 1 to 100 mg/kg/day. Hepatocellular adenomas and carcinomas were observed in both sexes of both species at doses greater than 25 mg/kg/day. Plasma drug levels in rats at this no-effect dose level, expressed as the AUC for enzyme inhibitory activity, were 3 to 11 times greater than those in humans at the maximum recommended dose, whereas serum levels at the no-effect level in mice were similar to those in humans. Additional findings in mice were increased incidences of pulmonary adenomas at doses greater than 25 mg/kg/day, and of Harderian gland adenomas at 400 mg/kg/day. In rats, the incidence of thyroid follicular adenoma was increased in females at doses greater than 5 mg/kg/day and in males at doses greater than 25 mg/kg/day. These thyroid tumours were associated with focal cystic follicular hyperplasia, and may be a secondary effect reflective of a simvastatin-mediated enhancement of thyroid hormone clearance by the liver.

#### Genotoxicity

##### VYTORIN

Ezetimibe alone or in combination with simvastatin did not cause gene mutation in bacteria or chromosomal damage in human peripheral lymphocytes or bone marrow cells in mice.

#### Effects on fertility

##### VYTORIN

There are no human data addressing the effects of ezetimibe/simvastatin combinations on fertility. In animal reproductive/fertility studies, no effect on pregnancy rates was observed in rats treated orally with ezetimibe/simvastatin at up to 1000/12.5 mg/kg. These doses correspond to exposure levels (based on AUC) approximately 1x (free ezetimibe), 20x (total ezetimibe), 0.8x (simvastatin), and 72x (hydroxysimvastatin) that expected in humans over the ezetimibe/simvastatin combination dose range (10/10 mg to 10/80 mg).

#### Thyroid Function

##### Simvastatin

The concentration of serum thyroxine has been measured at baseline and at the end of simvastatin treatment in 785 patients enrolled in multicentre studies. The results of this analysis indicate that simvastatin has little if any effect upon thyroxine activity.

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In one study involving 183 patients treated with simvastatin, four patients had TSH levels within the normal range before commencing simvastatin, but had an elevated TSH after two years of simvastatin therapy.

#### Transient Hypotension

##### Simvastatin

Three cases of symptomatic hypotension in the first few days following the start of simvastatin therapy have been reported. Two of the patients were on antihypertensive medication. The hypotension resolved with continued therapy with simvastatin.

#### Neurological Effects

##### Simvastatin

The neurological adverse effects reported to date include cases of peripheral neuropathy and paraesthesia possibly due to simvastatin.

#### Effects on Spermatogenesis and Testosterone

##### Simvastatin

In several studies of over 800 men with hypercholesterolaemia treated with simvastatin 20 mg to 80 mg per day for 12 to 48 weeks, basal testosterone levels were mildly decreased during simvastatin therapy, but there were no consistent changes in LH and FSH. In 86 men treated with simvastatin 20 mg to 80 mg per day, there was no impairment of hCG-stimulated testosterone secretion.

Testicular degeneration has been seen in two dog safety studies with simvastatin. Special studies designed to further define the nature of these changes have not met with success since the effects are poorly reproducible and unrelated to dose, serum cholesterol levels, or duration of treatment. Simvastatin has been administered for up to two years to dogs at a dose of 50 mg/kg/day without any testicular effects.

#### Use in Pregnancy (Category D)

Category D: Drugs which have caused, are suspected to have caused or may be expected to cause, an increased incidence of human foetal malformations or irreversible damage. These drugs may also have adverse pharmacological effects.

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## VYTORIN

VYTORIN is contraindicated during pregnancy. HMG-CoA reductase inhibitors, including simvastatin, a component of VYTORIN, are contraindicated in pregnancy. The risk of foetal injury outweighs the benefits of HMG-CoA reductase inhibitor, or medicines containing an HMG-CoA reductase inhibitor, therapy during pregnancy.

Atherosclerosis is a chronic process, and the discontinuation of lipid-lowering drugs during pregnancy should have little impact on the outcome of long-term therapy of primary hypercholesterolaemia.

The safety of ezetimibe/simvastatin combinations in pregnant women has not been established.

Cholesterol and other products of the cholesterol biosynthesis pathway are essential components for foetal development, including synthesis of steroids and cell membranes. Because of the ability of HMG-CoA reductase inhibitors to decrease the synthesis of cholesterol and possibly other products of the cholesterol biosynthetic pathway, VYTORIN, which contains simvastatin, is contraindicated during pregnancy. VYTORIN should be administered to women of childbearing age only when such patients are highly unlikely to conceive. If the patient becomes pregnant while taking this drug, VYTORIN should be discontinued and the patient informed of the potential hazard to the foetus. (see **CONTRAINDICATIONS**).

Ezetimibe in combination with statins in rats and rabbits resulted in higher exposures to ezetimibe and/or statins than either drug administered alone. Skeletal malformations (hemivertebrae in rats and shortened/filamentous tail associated with fused and reduced number of caudal vertebrae in rabbits) and other less severe foetal abnormalities were observed in rats and rabbits dosed with ezetimibe/statin combinations during organogenesis.

### Simvastatin

In two series of 178 and 134 cases where pregnant women took an HMG-CoA reductase inhibitor (statin) during the first trimester of pregnancy serious foetal abnormalities occurred in several cases. These included limb and neurological defects, spontaneous abortions and foetal deaths. The exact risk of injury to the foetus occurring after a pregnant woman is exposed to a HMG-CoA reductase inhibitor has not been determined. The current data do not indicate that the risk of foetal injury in women exposed to a HMG-CoA reductase inhibitor is high. If a pregnant woman is exposed to a HMG-CoA reductase inhibitor she should be informed of the possibility of foetal injury and discuss the implications with her pregnancy specialist.

Maternal treatment with simvastatin may reduce the foetal levels of mevalonate which is a precursor of cholesterol biosynthesis. For this reason, VYTORIN should not be used in women who are pregnant, trying to become pregnant or suspect they are pregnant. Treatment with

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VYTORIN should be suspended for the duration of pregnancy or until it has been determined that the woman is not pregnant (see **CONTRAINDICATIONS**).

#### Ezetimibe

No clinical data on exposed pregnancies are available for ezetimibe.

Ezetimibe crossed the placenta in rats and rabbits. There was no evidence of foetal abnormalities in rats dosed with up to 1000 mg/kg/day ezetimibe by oral gavage during organogenesis, corresponding to exposures about 1 and 7 times the adult human exposure for ezetimibe and total ezetimibe respectively, based on AUC. There was an increase in the incidence of extra thoracic ribs in rabbits at doses of 250 to 1000 mg/kg/day, corresponding to exposures 0.5 to 1 times and 100 to 150 times the adult human exposure for ezetimibe and total ezetimibe, respectively. The relevance of this finding to humans is not known.

#### ***Use in Lactation***

There are no human or animal data addressing the use of ezetimibe/simvastatin combinations during lactation. Because many drugs are excreted in human milk and because of the potential for serious adverse reactions, women taking VYTORIN should not breastfeed their infants (see **CONTRAINDICATIONS**).

#### Ezetimibe

Studies in rats showed that ezetimibe is excreted in milk. Ezetimibe had no effects on pup development in rats treated with up to 1000 mg/kg/day ezetimibe during late pregnancy and lactation. Drug exposures (based on AUC) in pups were approximately 1.5% (free ezetimibe) and 50% (total ezetimibe) of maternal exposures. It is not known whether ezetimibe is excreted into human breast milk.

#### Simvastatin

Animal studies have shown that weight gain during lactation is reduced in the offspring of rats dosed with simvastatin at dosages of 12.5 to 25 mg/kg/day. There is no information from animal studies on whether simvastatin or its metabolites are excreted in breast milk.

#### Use in the Elderly

No dosage adjustment is required for elderly patients (see *Characteristics in Special Populations*). Because advanced age ( $\geq 65$  years) is a predisposing factor for myopathy, VYTORIN should be prescribed with caution in the elderly. In a clinical trial of patients treated with simvastatin 80 mg/day, patients  $\geq 65$  years of age had an increased risk of myopathy compared to patients  $< 65$  years of age.

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## Paediatric Use

Treatment with VYTORIN is not recommended.

## Effects on ability to drive and use machines

No studies of the effects on the ability to drive and use of machines have been performed. However, certain side effects that have been reported with VYTORIN may affect some people's ability to drive or operate machinery. Individual responses to VYTORIN may vary (see ADVERSE EFFECTS).

## INTERACTIONS WITH OTHER MEDICINES

### VYTORIN

No clinically significant pharmacokinetic interaction was seen when ezetimibe was coadministered with simvastatin. Specific pharmacokinetic drug interaction studies with VYTORIN have not been performed.

VYTORIN is bioequivalent to coadministered ezetimibe and simvastatin.

### Contraindicated medicines

Concomitant use of the following medicines is contraindicated:

#### Potent Inhibitors of CYP3A4

In preclinical studies, it has been shown that ezetimibe does not induce cytochrome P450 drug metabolising enzymes. No clinically significant pharmacokinetic interactions have been observed between ezetimibe and drugs known to be metabolised by cytochromes P450 1A2, 2D6, 2C8, 2C9, and 3A4, or N-acetyltransferase.

Simvastatin is metabolised by CYP3A4 but has no CYP3A4 inhibitory activity; therefore it is not expected to affect the plasma concentrations of other drugs metabolised by CYP3A4.

Potent inhibitors of CYP3A4 increase the risk of myopathy by reducing the elimination of the simvastatin component of VYTORIN:

Concomitant use with medicines labeled as having a potent inhibitory effect on CYP3A4 (eg. itraconazole, ketoconazole, posaconazole, erythromycin, clarithromycin, telithromycin, HIV protease inhibitors, boceprevir, telaprevir, or nefazodone) is contraindicated. (see **CONTRAINDICATIONS, PRECAUTIONS, Myopathy/ Rhabdomyolysis, INTERACTIONS WITH OTHER MEDICINES**). Gemfibrozil, cyclosporine or danazol: (see

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CONTRAINDICATIONS; PRECAUTIONS, *Myopathy/Rhabdomyolysis*, INTERACTIONS WITH OTHER MEDICINES).

Other drug interactions

*Amiodarone*: The risk of myopathy/rhabdomyolysis is increased by concomitant administration of amiodarone with VYTORIN (see **DOSAGE AND ADMINISTRATION and PRECAUTIONS, Myopathy/Rhabdomyolysis, INTERACTIONS WITH OTHER MEDICINES**). During co-administration of amiodarone and simvastatin 80 mg in a large clinical trial, the risk of myopathy was approximately 6% (see **PRECAUTIONS, Myopathy/Rhabdomyolysis, INTERACTIONS WITH OTHER MEDICINES**).

*Cholestyramine*: Concomitant cholestyramine administration decreased the mean AUC of total ezetimibe (ezetimibe + ezetimibe glucuronide) approximately 55%. The incremental LDL-C reduction due to adding VYTORIN to cholestyramine may be lessened by this interaction.

*Calcium channel blockers*: The risk of myopathy/rhabdomyolysis is increased by concomitant administration of verapamil, diltiazem, or amlodipine (see **DOSAGE AND ADMINISTRATION; PRECAUTIONS, Myopathy/Rhabdomyolysis, INTERACTIONS WITH OTHER MEDICINES**).

*Moderate inhibitors of CYP3A4*: Patients taking other medicines labeled as having a moderate inhibitory effect on CYP3A4 concomitantly with VYTORIN, particularly higher VYTORIN doses, may have an increased risk of myopathy.

*Fusidic Acid*: Patients on fusidic acid treated concomitantly with VYTORIN may have an increased risk of myopathy (see **PRECAUTIONS, Myopathy/Rhabdomyolysis, INTERACTIONS WITH OTHER MEDICINES**).

*Fibrates*: Concomitant fenofibrate or gemfibrozil administration increased total ezetimibe concentrations approximately 1.5- and 1.7-fold, respectively; however, these increases are not considered clinically significant. The safety and effectiveness of VYTORIN administered with fibrates have not been established. Fibrates may increase cholesterol excretion into the bile, leading to cholelithiasis. In a preclinical study in dogs, ezetimibe increased cholesterol in the gallbladder bile. Although the relevance of this preclinical finding to humans is unknown, coadministration of VYTORIN with fibrates is not recommended until use in patients is studied.

*Niacin*: In a study of 15 healthy adults, concomitant VYTORIN (10/20mg daily for 7 days) caused a small increase in the mean AUCs of niacin (22%, 90% Confidence Interval (CI), -28 to 105) and nicotinuric acid (19%, 90% CI, -1 to 43) [n=13] administered as NIASPAN extended-release tablets (1000mg for 2 days and 2000mg for 5 days following a low-fat breakfast). In the same study, concomitant NIASPAN slightly increased the mean AUCs of ezetimibe (9%, 90%



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CI, -2 to 22), total ezetimibe (26%, 90% CI, 10 to 44), simvastatin (20%, 90% CI, 3 to 40) and simvastatin acid (35%, 90% CI, -3 to 88) [n=15].

*Colchicine:* There have been reports of myopathy and rhabdomyolysis with the concomitant administration of colchicine and simvastatin in patients with renal insufficiency. Close clinical monitoring of patients taking this combination is advised.

*Grapefruit juice:* contains one or more components that inhibit CYP3A4 and can increase the plasma levels of drugs metabolised by CYP3A4. The effect of typical consumption (one 250-mL glass daily) is minimal (13% increase in active plasma HMG-CoA reductase inhibitory activity as measured by the area under the concentration-time curve) and of no clinical relevance. However, very large quantities (over 1 litre daily) significantly increase the plasma levels of HMG-CoA reductase inhibitory activity during simvastatin therapy and should be avoided while taking VYTORIN (see **PRECAUTIONS, Myopathy/Rhabdomyolysis**).

*Coumarin derivatives:* In two clinical studies, one in normal volunteers and the other in hypercholesterolaemic patients, simvastatin 20-40 mg/day modestly potentiated the effect of coumarin anticoagulants: the prothrombin time, reported as International Normalised Ratio (INR), increased from a baseline of 1.7 to 1.8 and from 2.6 to 3.4 in the volunteer and patient studies, respectively. In patients taking coumarin anticoagulants, prothrombin time should be determined before starting VYTORIN and frequently enough during early therapy to ensure that no significant alteration of prothrombin time occurs. Once a stable prothrombin time has been documented, prothrombin times can be monitored at the intervals usually recommended for patients on coumarin anticoagulants. If the dose of VYTORIN is changed or discontinued, the same procedure should be repeated. Simvastatin therapy has not been associated with bleeding or with changes in prothrombin time in patients not taking anticoagulants.

Concomitant administration of ezetimibe (10 mg once daily) for 11 days had no significant effect on bioavailability of a single dose 25 mg warfarin, administered on day 7, and prothrombin time in a cross-over study of twelve healthy adult males. There have been post-marketing reports of increased International Normalised Ratio in patients who had ezetimibe added to warfarin. Most of these patients were also on other medications (see **PRECAUTIONS**).

The effect of VYTORIN on the prothrombin time has not been studied.

*Antacids:* Concomitant antacid administration decreased the rate of absorption of ezetimibe but had no effect on the bioavailability of ezetimibe. This decreased rate of absorption is not considered clinically significant.

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*Cyclosporin:* In a study of eight post-renal transplant patients with creatinine clearance of >50 mL/min on a stable dose of cyclosporin, a single 10-mg dose of ezetimibe resulted in a 3.4-fold (range 2.3- to 7.9-fold) increase in the mean AUC for total ezetimibe compared to a healthy control population from another study (n=17).

In a different study, a renal transplant patient with severe renal insufficiency (creatinine clearance of 13.2 mL/min/1.73 m<sup>2</sup>) who was receiving multiple medications, including cyclosporin, demonstrated a 12-fold greater exposure to total ezetimibe compared to concurrent controls. In a two-period crossover study in twelve healthy subjects, daily administration of 20 mg ezetimibe for 8 days with a single 100mg dose of cyclosporin on Day 7 resulted in a mean 15% increase in cyclosporin AUC (range 10% decrease to 51% increase) compared to a single 100 mg dose of cyclosporin alone (see **PRECAUTIONS**).

The pharmacokinetic interactions between ezetimibe at steady-state and cyclosporin also at steady-state have not been studied.

*Digoxin:* concomitant administration of simvastatin and digoxin in normal volunteers resulted in a slight elevation (less than 0.3 ng/mL) in plasma drug concentrations (as measured by a digoxin radioimmunoassay) compared to concomitant administration of placebo and digoxin. Patients taking digoxin should be monitored appropriately when simvastatin is initiated.

## ADVERSE EFFECTS

VYTORIN (or co-administration of ezetimibe and simvastatin equivalent to VYTORIN) has been evaluated for safety in more than 3800 patients in clinical trials. VYTORIN was generally well tolerated.

The following common drug-related adverse experiences were reported occurring in ≥ 1% of patients taking VYTORIN (n=1236) during three, similarly designed, placebo-controlled trials:

Placebo	Ezetimibe 10 mg	Simvastatin*	VYTORIN*
(%)	(%)	(%)	(%)
n=311	n=302	n=1234	n=1236

Gastrointestinal disorders

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Flatulence	1.0	1.0	1.1	1.1
Nervous system disorders				
Headache	1.3	1.3	1.4	1.4
Musculoskeletal and connective tissue, and bone disorders				
Myalgia	1.3	1.7	1.5	2.0

\* All doses

#### Laboratory Values

In controlled clinical co-administration trials, the incidence of clinically important elevations in serum transaminases (ALT and/or AST  $\geq 3$  X ULN, consecutive) was 1.7% for patients treated with VYTORIN. These elevations were generally asymptomatic, not associated with cholestasis, and returned to baseline after discontinuation of therapy or with continued treatment (see **PRECAUTIONS**).

Clinically important elevations of CK ( $\geq 10$  X ULN) were seen in 0.2% of the patients treated with VYTORIN.

#### Patients with Chronic Kidney Disease

In the Study of Heart and Renal Protection (SHARP) (see **CLINICAL TRIALS**, Prevention of Major Vascular Events in Chronic Kidney Disease (CKD)), involving over 9,000 patients treated with VYTORIN 10/20 daily (n=4,650) or placebo (n=4,620), the safety profiles were comparable during a median follow-up period of 4.9 years. In this trial, only serious adverse events and discontinuations due to any adverse events were recorded. Discontinuation rates due to adverse events were comparable (10.4% in patients treated with VYTORIN, 9.8% in patients treated with placebo). The incidence of myopathy/rhabdomyolysis was 0.2% in patients treated with VYTORIN and 0.1% in patients treated with placebo. Consecutive elevations of transaminases ( $>3$  X ULN) occurred in 0.7% of patients treated with VYTORIN compared with

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0.6% of patients treated with placebo. In this trial, there were no statistically significant increases in the incidence of pre-specified adverse events, including cancer (9.4% for VYTORIN, 9.5% for placebo), hepatitis, cholecystectomy or complications of gallstones or pancreatitis.

#### Post-marketing Experience

The adverse reactions reported for VYTORIN are consistent with those previously reported with ezetimibe and/or simvastatin.

Additional adverse events reported commonly with **ezetimibe** during clinical trials:

*Gastrointestinal disorders:* abdominal pain, diarrhoea; gastritis

General disorders and administration site conditions: fatigue

*Investigations:* liver function test abnormal

Respiratory, thoracic and mediastinal disorders: cough

Metabolism and nutrition disorders: decreased appetite

*Vascular disorders:* hot flush; hypertension

General disorders and administration site conditions: pain

Additional adverse events reported rarely, regardless of causality assessment, with **ezetimibe** during post-marketing use:

Blood and lymphatic system disorders: thrombocytopenia.

*Hepato-biliary disorders:* cholelithiasis, cholecystitis, hepatitis

*Musculoskeletal, connective tissue and bone disorders:* arthralgia and, very rarely myopathy/rhabdomyolysis (see **PRECAUTIONS**)

Psychiatric disorders: depression

*Nervous system disorders:* dizziness; paraesthesia (very rare)

*Skin and subcutaneous tissue disorders:* Hypersensitivity reactions, including rash and urticaria (rare [ $\geq 1/10,000$ ,  $< 1/10000$ ]) and anaphylaxis and angioedema (very rare [ $< 1/10,000$ ]), erythema multiforme

*Gastrointestinal disorders:* nausea (rare) and pancreatitis (very rare)

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*Laboratory values:* increased CPK; elevations of liver transaminases

Additional adverse events reported rarely with **simvastatin** during clinical studies and/or post-marketing use:

Blood and lymphatic system disorders: anaemia;

*Gastrointestinal disorders:* abdominal pain, constipation, diarrhoea, dyspepsia, nausea, vomiting, pancreatitis;

General disorders and administration site conditions: asthenia

*Hepatic disorders:* hepatitis/jaundice and very rarely, hepatic failure;

Reproductive system and breast disorders: erectile dysfunction

*Musculoskeletal, connective tissue and bone disorders:* muscle cramps, myopathy, rhabdomyolysis (see **PRECAUTIONS**);

*Nervous system disorders:* dizziness, paraesthesia, peripheral neuropathy, cognitive impairment;

Respiratory, thoracic and mediastinal disorders: interstitial lung disease

Skin and subcutaneous tissue disorders: alopecia, pruritus, rash;

Psychiatric disorders: insomnia.

An apparent hypersensitivity syndrome has been reported rarely which has included some of the following features: angioedema, lupus-like syndrome, polymyalgia rheumatica, dermatomyositis, vasculitis, thrombocytopenia, eosinophilia, ESR increased, arthritis and arthralgia, urticaria, photosensitivity, fever, flushing, dyspnoea and malaise.

There has been rare postmarketing reports of cognitive impairment (e.g., memory loss, forgetfulness, amnesia, memory impairment, confusion) associated with statin use. These cognitive issues have been reported for all statins. The reports are generally non-serious, and reversible upon statin discontinuation, with variable times to symptom onset (1 day to years) and symptom resolution (median of 3 weeks).

*Laboratory Values:* Elevated alkaline phosphatase and  $\gamma$ -glutamyl transpeptidase have been reported with simvastatin.

Increases in HbA1c and fasting serum glucose levels have been reported with statins, including simvastatin.

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## **DOSAGE AND ADMINISTRATION**

### Dosage Recommendations

The patient should be placed on a standard cholesterol-lowering diet before receiving VYTORIN and should continue on this diet during treatment with VYTORIN. VYTORIN can be administered within the range of 10/10 mg/day to 10/80 mg/day. The usual starting dose is 10/10 mg/day to 10/40 mg/day. The dosage should be individualised according to the baseline LDL-C level, the recommended goal of therapy, and the patient's response. The 10/80mg dose of VYTORIN should only be used in patients at high risk for cardiovascular complications who have not achieved their treatment goals on lower doses and when the benefits are expected to outweigh the potential risks (see **PRECAUTIONS, Myopathy/Rhabdomyolysis**). VYTORIN should be taken as a single daily dose in the evening, with or without food. After initiation or titration of VYTORIN, lipid levels may be analysed after 2 or more weeks and dosage adjusted, if needed.

### Dosage in Patients with Homozygous Familial Hypercholesterolaemia

The recommended dosage for patients with homozygous familial hypercholesterolaemia is VYTORIN 10/40 mg/day or 10/80 mg/day in the evening. The 10/80 mg dose should only be used when the benefits are expected to outweigh the potential risks (see **CONTRAINDICATIONS; PRECAUTIONS, Myopathy/Rhabdomyolysis**).

VYTORIN should be used as an adjunct to other lipid-lowering treatments (e.g., LDL apheresis) in these patients or if such treatments are unavailable.

### Patients with Renal Impairment/Chronic Kidney Disease

In patients with mild renal insufficiency (estimated GFR  $\geq 60$  mL/min/1.73 m<sup>2</sup>) no dosage adjustment is necessary. In patients with chronic kidney disease and estimated glomerular filtration rate  $< 60$  mL/min/1.73 m<sup>2</sup>, the dose of VYTORIN is 10/20 mg once a day in the evening. In such patients, the use of higher doses should be closely monitored. (See **PRECAUTIONS, Characteristics in Special Populations** and **CLINICAL TRIALS**).

### Use in the Elderly

No dosage adjustment is required for elderly patients (see *Characteristics in Special Populations*).

### Paediatric Use

Treatment with VYTORIN is not recommended.

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### Hepatic Insufficiency

No dosage adjustment is required in patients with mild hepatic insufficiency (Child-Pugh score 5 or 6). Treatment with VYTORIN is not recommended in patients with moderate (Child-Pugh score 7 to 9) or severe (Child-Pugh score > 9) liver dysfunction. (see **PRECAUTIONS** and *Characteristics in Special Populations*)

### Coadministration with other medicines

Dosing of VYTORIN should occur either  $\geq 2$  hours before or  $\geq 4$  hours after administration of a bile acid sequestrant.

In patients taking amiodarone, verapamil, diltiazem or  $\geq 1$  g/day of niacin concomitantly with VYTORIN, the dose of VYTORIN should not exceed 10/20 mg/day (see **PRECAUTIONS**, ***Myopathy/Rhabdomyolysis***, **INTERACTIONS WITH OTHER MEDICINES**).

In patients taking amlodipine concomitantly with VYTORIN, the dose of VYTORIN should not exceed 10/40 mg/day (see **CONTRAINDICATIONS; PRECAUTIONS**, ***Myopathy/Rhabdomyolysis***, **INTERACTIONS WITH OTHER MEDICINES**).

The safety and effectiveness of VYTORIN administered with fibrates have not been studied. Therefore, the concomitant use of VYTORIN and fibrates should be avoided. **Concomitant use of gemfibrozil is contraindicated.**(see **CONTRAINDICATIONS**, **PRECAUTIONS** ***Myopathy/Rhabdomyolysis***, **INTERACTIONS WITH OTHER MEDICINES**).

## **OVERDOSAGE**

### VYTORIN

No specific treatment of overdosage with VYTORIN can be recommended. In the event of an overdose, symptomatic and supportive measures should be employed. Co-administration of ezetimibe (1000 mg/kg) and simvastatin (1000 mg/kg) was well-tolerated in acute, oral toxicity studies in mice and rats. No clinical signs of toxicity were observed in these animals. The estimated oral LD<sub>50</sub> for both species was ezetimibe  $\geq 1000$  mg/kg/simvastatin  $\geq 1000$  mg/kg.

Contact the Poisons Information Centre for advice on management.

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## Ezetimibe

In clinical studies, administration of ezetimibe, 50 mg/day to 15 healthy subjects for up to 14 days, or 40 mg/day to 18 patients with primary hypercholesterolemia for up to 56 days was generally well tolerated.

A few cases of overdosage have been reported; most have not been associated with adverse experiences. Reported adverse experiences have not been serious.

## Simvastatin

A few cases of overdosage have been reported; the maximum dose taken was 3.6 g. All patients recovered without sequelae.

## PRESENTATION AND STORAGE CONDITIONS

VYTORIN is available in the following presentations:

VYTORIN 10/10: [10mg Ezetimibe/ 10mg Simvastatin]: White to off-white, capsule shaped, biconvex compressed tablet marked with "311". Blister packs of 5, 10 and 30.

VYTORIN 10/20 [10mg Ezetimibe/ 20mg Simvastatin]: White to off-white, capsule shaped, biconvex compressed tablet marked with "312". Blister packs of 5, 10 and 30.

VYTORIN 10/40 [10mg Ezetimibe/ 40mg Simvastatin]: White to off-white, capsule shaped, biconvex compressed tablet marked with "313". Blister packs of 5, 10 and 30.

VYTORIN 10/80 [10mg Ezetimibe/ 80mg Simvastatin]: White to off-white, capsule shaped, biconvex compressed tablet marked with "315". Blister packs of 5, 10 and 30.

Store below 25°C. Store in original packaging.

## NAME AND ADDRESS OF THE SPONSOR

MERCK SHARP & DOHME (AUSTRALIA) PTY LIMITED

54-68 FERNDILL STREET

SOUTH GRANVILLE NSW 2142

AUSTRALIA



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***POISON SCHEDULE OF THE MEDICINE***

Prescription only medicine (S4).

**DATE OF FIRST INCLUSION IN THE AUSTRALIAN REGISTER OF THERAPEUTIC GOODS**

7 Jan 2005

**DATE OF MOST RECENT AMENDMENT**

This document was approved by the Therapeutic Goods Administration on TBD.

Notification date of the latest safety related change: 01 March 2012.