

## HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use GLYXAMBI safely and effectively. See full prescribing information for GLYXAMBI.

**GLYXAMBI® (empagliflozin and linagliptin) tablets, for oral use**  
**Initial U.S. Approval: 2015**

### -----INDICATIONS AND USAGE-----

GLYXAMBI is a sodium-glucose co-transporter 2 (SGLT2) inhibitor and dipeptidyl peptidase-4 (DPP-4) inhibitor combination product indicated as an adjunct to diet and exercise to improve glycemic control in adults with type 2 diabetes mellitus when treatment with both empagliflozin and linagliptin is appropriate. (1.1)

#### Limitations of use:

- Not for the treatment of type 1 diabetes mellitus or diabetic ketoacidosis (1.1)
- Has not been studied in patients with a history of pancreatitis (1.1)

### -----DOSAGE AND ADMINISTRATION-----

- The recommended dose of GLYXAMBI is 10 mg empagliflozin/5 mg linagliptin once daily, taken in the morning, with or without food (2.1)
- Dose may be increased to 25 mg empagliflozin/5 mg linagliptin once daily (2.1)
- Assess renal function before initiating GLYXAMBI. Do not initiate GLYXAMBI if eGFR is below 45 mL/min/1.73 m<sup>2</sup> (2.2)
- Discontinue GLYXAMBI if eGFR falls persistently below 45 mL/min/1.73 m<sup>2</sup> (2.2)

### -----DOSAGE FORMS AND STRENGTHS-----

Tablets:

- 10 mg empagliflozin/5 mg linagliptin
- 25 mg empagliflozin/5 mg linagliptin (3)

### -----CONTRAINDICATIONS-----

- Severe renal impairment, end-stage renal disease, or dialysis (4)
- History of hypersensitivity reaction to linagliptin, such as anaphylaxis, angioedema, exfoliative skin conditions, urticaria, or bronchial hyperreactivity (4)
- History of serious hypersensitivity reaction to empagliflozin (4)

### -----WARNINGS AND PRECAUTIONS-----

- **Pancreatitis:** There have been postmarketing reports of acute pancreatitis, including fatal pancreatitis. If pancreatitis is suspected, promptly discontinue GLYXAMBI. (5.1)

- **Hypotension:** Before initiating GLYXAMBI assess and correct volume status in patients with renal impairment, the elderly, in patients with low systolic blood pressure, and in patients on diuretics. Monitor for signs and symptoms during therapy. (5.2)
- **Impairment in Renal Function:** Monitor renal function during therapy. More frequent monitoring is recommended in patients with eGFR below 60 mL/min/1.73 m<sup>2</sup>. (5.3)
- **Hypoglycemia:** Consider lowering the dose of insulin secretagogue or insulin to reduce the risk of hypoglycemia when initiating GLYXAMBI. (5.4)
- **Genital Mycotic Infections:** Monitor and treat as appropriate (5.5)
- **Urinary Tract Infections:** Monitor and treat as appropriate (5.6)
- **Hypersensitivity:** There have been postmarketing reports of serious hypersensitivity reactions in patients treated with linagliptin (one of the components of GLYXAMBI) including anaphylaxis, angioedema, and exfoliative skin conditions. In such cases, promptly discontinue GLYXAMBI, assess for other potential causes, institute appropriate monitoring and treatment, and initiate alternative treatment for diabetes. (5.7)
- **Increased LDL-C:** Monitor and treat as appropriate (5.8)
- **Macrovascular Outcomes:** There have been no clinical studies establishing conclusive evidence of macrovascular risk reduction with GLYXAMBI or any other antidiabetic drug. (5.9)

### -----ADVERSE REACTIONS-----

- The most common adverse reactions associated with GLYXAMBI (a 5% or greater incidence) were urinary tract infections, nasopharyngitis, and upper respiratory tract infections. (6.1)

**To report SUSPECTED ADVERSE REACTIONS, contact Boehringer Ingelheim Pharmaceuticals, Inc. at 1-800-542-6257 or 1-800-459-9906 TTY, or FDA at 1-800-FDA-1088 or www.fda.gov/medwatch.**

### -----USE IN SPECIFIC POPULATIONS-----

- **Pregnancy:** There are no adequate and well-controlled studies in pregnant women. Use during pregnancy only if the potential benefit justifies the potential risk to the fetus. (8.1)
- **Nursing Mothers:** Discontinue GLYXAMBI or discontinue nursing (8.3)
- **Pediatric Patients:** Safety and effectiveness of GLYXAMBI in pediatric patients have not been established. (8.4)
- **Geriatric Patients:** Higher incidence of adverse reactions related to volume depletion and reduced renal function (5.2, 5.3, 8.5)
- **Renal Impairment:** Higher incidence of adverse reactions related to reduced renal function (2.2, 5.3, 8.6)

**See 17 for PATIENT COUNSELING INFORMATION and Medication Guide.**

**Revised: 1/2015**

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## FULL PRESCRIBING INFORMATION

### 1 INDICATIONS AND USAGE

GLYXAMBI tablets are indicated as an adjunct to diet and exercise to improve glycemic control in adults with type 2 diabetes mellitus when treatment with both empagliflozin and linagliptin is appropriate [see *Clinical Studies (14)*].

#### 1.1 Limitations of Use

GLYXAMBI is not recommended for patients with type 1 diabetes or for the treatment of diabetic ketoacidosis.

GLYXAMBI has not been studied in patients with a history of pancreatitis. It is unknown whether patients with a history of pancreatitis are at an increased risk for the development of pancreatitis while using GLYXAMBI [see *Warnings and Precautions (5.1)*].

### 2 DOSAGE AND ADMINISTRATION

#### 2.1 Recommended Dosage

The recommended dose of GLYXAMBI is 10 mg empagliflozin/5 mg linagliptin once daily in the morning, taken with or without food. In patients tolerating GLYXAMBI, the dose may be increased to 25 mg empagliflozin/5 mg linagliptin once daily.

In patients with volume depletion, correcting this condition prior to initiation of GLYXAMBI is recommended [see *Warnings and Precautions (5.1)*, *Use in Specific Populations (8.5)*, and *Patient Counseling Information (17)*].

No studies have been performed specifically examining the safety and efficacy of GLYXAMBI in patients previously treated with other oral antihyperglycemic agents and switched to GLYXAMBI. Any change in therapy of type 2 diabetes should be undertaken with care and appropriate monitoring as changes in glycemic control can occur.

#### 2.2 Patients with Renal Impairment

Assessment of renal function is recommended prior to initiation of GLYXAMBI and periodically thereafter.

GLYXAMBI should not be initiated in patients with an eGFR less than 45 mL/min/1.73 m<sup>2</sup>.

No dose adjustment is needed in patients with an eGFR greater than or equal to 45 mL/min/1.73 m<sup>2</sup>.

GLYXAMBI should be discontinued if eGFR is persistently less than 45 mL/min/1.73 m<sup>2</sup> [see *Warnings and Precautions (5.2, 5.3)*, and *Use in Specific Populations (8.6)*].

### 3 DOSAGE FORMS AND STRENGTHS

GLYXAMBI is a combination of empagliflozin and linagliptin. GLYXAMBI is available in the following dosage forms and strengths:

- 10 mg empagliflozin/5 mg linagliptin tablets are pale yellow, arc triangular, flat-faced, bevel-edged film-coated tablets. One side is debossed with the Boehringer Ingelheim company symbol; the other side is debossed with "10/5".

- 25 mg empagliflozin/5 mg linagliptin tablets are pale pink, arc triangular, flat-faced, bevel-edged film-coated tablets. One side is debossed with the Boehringer Ingelheim company symbol; the other side is debossed with "25/5".

## 4 CONTRAINDICATIONS

GLYXAMBI is contraindicated in patients with:

- Severe renal impairment, end-stage renal disease, or dialysis [see *Use in Specific Populations (8.6)*].
- A history of hypersensitivity reaction to linagliptin, such as anaphylaxis, angioedema, exfoliative skin conditions, urticaria, or bronchial hyperreactivity [see *Warnings and Precautions (5.7) and Adverse Reactions (6)*].
- History of serious hypersensitivity reaction to empagliflozin.

## 5 WARNINGS AND PRECAUTIONS

### 5.1 Pancreatitis

There have been postmarketing reports of acute pancreatitis, including fatal pancreatitis, in patients taking linagliptin. Take careful notice of potential signs and symptoms of pancreatitis. If pancreatitis is suspected, promptly discontinue GLYXAMBI and initiate appropriate management. It is unknown whether patients with a history of pancreatitis are at increased risk for the development of pancreatitis while using GLYXAMBI.

### 5.2 Hypotension

Empagliflozin causes intravascular volume contraction. Symptomatic hypotension may occur after initiating empagliflozin [see *Adverse Reactions (6.1)*] particularly in patients with renal impairment, the elderly, in patients with low systolic blood pressure, and in patients on diuretics. Before initiating GLYXAMBI, assess for volume contraction and correct volume status if indicated. Monitor for signs and symptoms of hypotension after initiating therapy and increase monitoring in clinical situations where volume contraction is expected [see *Use in Specific Populations (8.5)*].

### 5.3 Impairment in Renal Function

Empagliflozin increases serum creatinine and decreases eGFR. The risk of impaired renal function with empagliflozin is increased in elderly patients and patients with moderate renal impairment. More frequent monitoring of renal function is recommended in these patients [see *Use in Specific Populations (8.5, 8.6)*]. Renal function should be evaluated prior to initiating GLYXAMBI and periodically thereafter.

### 5.4 Hypoglycemia with Concomitant Use with Insulin and Insulin Secretagogues

Insulin and insulin secretagogues are known to cause hypoglycemia. The use of empagliflozin or linagliptin in combination with an insulin secretagogue (e.g., sulfonylurea) or insulin was associated with a higher rate of hypoglycemia compared with placebo in a clinical trial. Therefore, a lower dose of the insulin secretagogue or insulin may be required to reduce the risk of hypoglycemia when used in combination with GLYXAMBI.

### 5.5 Genital Mycotic Infections

Empagliflozin increases the risk for genital mycotic infections [see *Adverse Reactions (6.1)*]. Patients with a history of chronic or recurrent genital mycotic infections were more likely to develop mycotic genital infections. Monitor and treat as appropriate.

### 5.6 Urinary Tract Infections

Empagliflozin increases the risk for urinary tract infections [see *Adverse Reactions (6.1)*]. Monitor and treat as appropriate.

## 5.7 Hypersensitivity Reactions

There have been postmarketing reports of serious hypersensitivity reactions in patients treated with linagliptin (one of the components of GLYXAMBI). These reactions include anaphylaxis, angioedema, and exfoliative skin conditions. Onset of these reactions occurred within the first 3 months after initiation of treatment with linagliptin, with some reports occurring after the first dose. If a serious hypersensitivity reaction is suspected, discontinue GLYXAMBI, assess for other potential causes for the event, and institute alternative treatment for diabetes.

Angioedema has also been reported with other dipeptidyl peptidase-4 (DPP-4) inhibitors. Use caution in a patient with a history of angioedema to another DPP-4 inhibitor because it is unknown whether such patients will be predisposed to angioedema with GLYXAMBI.

## 5.8 Increased Low-Density Lipoprotein Cholesterol (LDL-C)

Increases in LDL-C can occur with empagliflozin [see *Adverse Reactions (6.1)*]. Monitor and treat as appropriate.

## 5.9 Macrovascular Outcomes

There have been no clinical studies establishing conclusive evidence of macrovascular risk reduction with GLYXAMBI or any other antidiabetic drug.

# 6 ADVERSE REACTIONS

## 6.1 Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

### *Empagliflozin and Linagliptin*

The safety of concomitantly administered empagliflozin (daily dose 10 mg or 25 mg) and linagliptin (daily dose 5 mg) has been evaluated in a total of 1363 patients with type 2 diabetes treated for up to 52 weeks in active-controlled clinical trials. The most common adverse reactions with concomitant administration of empagliflozin and linagliptin based on a pooled analyses of these studies are shown in Table 1.

**Table 1 Adverse Reactions Reported in  $\geq 5\%$  of Patients Treated with Empagliflozin and Linagliptin**

	<b>GLYXAMBI 10 mg/5 mg n=272</b>	<b>GLYXAMBI 25 mg/5 mg n=273</b>
	<b>n (%)</b>	<b>n (%)</b>
Urinary tract infection <sup>a</sup>	34 (12.5)	31 (11.4)
Nasopharyngitis	16 (5.9)	18 (6.6)
Upper respiratory tract infection	19 (7.0)	19 (7.0)

<sup>a</sup>Predefined adverse event grouping, including, but not limited to, urinary tract infection, asymptomatic bacteriuria, cystitis

### *Empagliflozin*

Adverse reactions that occurred in  $\geq 2\%$  of patients receiving empagliflozin and more commonly than in patients given placebo included (10 mg, 25 mg, and placebo): urinary tract infection (9.3%, 7.6%, and 7.6%), female genital mycotic infections (5.4%, 6.4%, and 1.5%), upper respiratory tract infection (3.1%, 4.0%, and 3.8%), increased urination (3.4%, 3.2%, and 1.0%), dyslipidemia (3.9%, 2.9%, and 3.4%), arthralgia (2.4%, 2.3%, and 2.2%), male genital mycotic infections (3.1%, 1.6%, and 0.4%), and nausea (2.3%, 1.1%, and 1.4%).

Empagliflozin causes an osmotic diuresis, which may lead to intravascular volume contraction and adverse reactions related to volume depletion.

### *Linagliptin*

Adverse reactions reported in  $\geq 2\%$  of patients treated with linagliptin 5 mg and more commonly than in patients treated with placebo included: nasopharyngitis (7.0% and 6.1%), diarrhea (3.3% and 3.0%), and cough (2.1% and 1.4%).

Other adverse reactions reported in clinical studies with treatment of linagliptin monotherapy were hypersensitivity (e.g., urticaria, angioedema, localized skin exfoliation, or bronchial hyperreactivity) and myalgia.

In the clinical trial program, pancreatitis was reported in 15.2 cases per 10,000 patient year exposure while being treated with linagliptin compared with 3.7 cases per 10,000 patient year exposure while being treated with comparator (placebo and active comparator, sulfonylurea). Three additional cases of pancreatitis were reported following the last administered dose of linagliptin.

### *Hypoglycemia*

Table 2 summarizes the reports of hypoglycemia with empagliflozin and linagliptin over a treatment period of 52 weeks.

**Table 2 Incidence of Overall<sup>a</sup> and Severe<sup>b</sup> Hypoglycemic Adverse Reactions**

<b>Add-on to Metformin (52 weeks)</b>	<b>GLYXAMBI 10 mg/5 mg (n=136)</b>	<b>GLYXAMBI 25 mg/5 mg (n=137)</b>
Overall (%)	2.2%	3.6%
Severe (%)	0%	0%

<sup>a</sup>Overall hypoglycemic events: plasma or capillary glucose of less than or equal to 70 mg/dL or requiring assistance

<sup>b</sup>Severe hypoglycemic events: requiring assistance regardless of blood glucose

### *Laboratory Tests*

#### Empagliflozin and Linagliptin

Changes in laboratory findings in patients treated with the combination of empagliflozin and linagliptin included increases in cholesterol and hematocrit compared to baseline.

#### Empagliflozin

*Increase in Low-Density Lipoprotein Cholesterol (LDL-C):* Dose-related increases in low-density lipoprotein cholesterol (LDL-C) were observed in patients treated with empagliflozin. LDL-C increased by 2.3%, 4.6%, and 6.5% in patients treated with placebo, empagliflozin 10 mg, and empagliflozin 25 mg, respectively [*see Warnings and Precautions (5.8)*]. The range of mean baseline LDL-C levels was 90.3 to 90.6 mg/dL across treatment groups.

*Increase in Hematocrit:* Median hematocrit decreased by 1.3% in placebo and increased by 2.8% in empagliflozin 10 mg and 2.8% in empagliflozin 25 mg treated patients. At the end of treatment, 0.6%, 2.7%, and 3.5% of patients with hematocrits initially within the reference range had values above the upper limit of the reference range with placebo, empagliflozin 10 mg, and empagliflozin 25 mg, respectively.

#### Linagliptin

Changes in laboratory values that occurred more frequently in the linagliptin group and  $\geq 1\%$  more than in the placebo group were increases in uric acid (1.3% in the placebo group, 2.7% in the linagliptin group).

## 6.2 Postmarketing Experience

Additional adverse reactions have been identified during postapproval use of linagliptin. Because these reactions are reported voluntarily from a population of uncertain size, it is generally not possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

- Acute pancreatitis, including fatal pancreatitis [*see Indications and Usage (1.1) and Warnings and Precautions (5.1)*]
- Hypersensitivity reactions including anaphylaxis, angioedema, and exfoliative skin conditions [*see Warnings and Precautions (5.7)*]
- Rash

## 7 DRUG INTERACTIONS

### 7.1 Drug Interactions with Empagliflozin

#### *Diuretics*

Coadministration of empagliflozin with diuretics resulted in increased urine volume and frequency of voids, which might enhance the potential for volume depletion [*see Warnings and Precautions (5.2)*].

#### *Insulin or Insulin Secretagogues*

Coadministration of empagliflozin with insulin or insulin secretagogues increases the risk for hypoglycemia [*see Warnings and Precautions (5.4)*].

#### *Positive Urine Glucose Test*

Monitoring glycemic control with urine glucose tests is not recommended in patients taking SGLT2 inhibitors as SGLT2 inhibitors increase urinary glucose excretion and will lead to positive urine glucose tests. Use alternative methods to monitor glycemic control.

#### *Interference with 1,5-anhydroglucitol (1,5-AG) Assay*

Monitoring glycemic control with 1,5-AG assay is not recommended as measurements of 1,5-AG are unreliable in assessing glycemic control in patients taking SGLT2 inhibitors. Use alternative methods to monitor glycemic control.

### 7.2 Drug Interactions with Linagliptin

#### *Inducers of P-glycoprotein or CYP3A4 Enzymes*

Rifampin decreased linagliptin exposure, suggesting that the efficacy of linagliptin may be reduced when administered in combination with a strong P-gp or CYP3A4 inducer. Therefore, use of alternative treatments is strongly recommended when linagliptin is to be administered with a strong P-gp or CYP3A4 inducer [*see Clinical Pharmacology (12.3)*].

## 8 USE IN SPECIFIC POPULATIONS

### 8.1 Pregnancy

#### *Pregnancy Category C*

#### *GLYXAMBI*

There are no adequate and well-controlled studies in pregnant women with GLYXAMBI or its individual components. GLYXAMBI should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

### Animal Data

The combined components administered during the period of organogenesis were not teratogenic in rats up to and including a combined dose of 700 mg/kg/day empagliflozin and 140 mg/kg/day linagliptin, which is 253 and 353 times the clinical exposure. Maternal effects were limited to dose-related reduced body weight gain and concomitant reduced food consumption in pregnant rats administered a combination of  $\geq 300$  mg/kg/day empagliflozin and 60 mg/kg/day linagliptin which is 99 and 227 times the clinical exposure. A pre- and post-natal development study was not conducted with the combined components of GLYXAMBI.

#### *Empagliflozin*

Based on results from animal studies, empagliflozin may affect renal development and maturation. In studies conducted in rats, empagliflozin crosses the placenta and reaches fetal tissues. During pregnancy, consider appropriate alternative therapies, especially during the second and third trimesters.

In pre- and postnatal development studies in pregnant rats, empagliflozin was administered from gestation day 6 through to lactation day 20 (weaning) at up to 100 mg/kg/day (approximately 16 times the 25 mg maximum clinical dose) without maternal toxicity. Reduced body weight was observed in the offspring at greater than or equal to 30 mg/kg/day (approximately 4 times the 25 mg maximum clinical dose).

#### *Linagliptin*

No functional, behavioral, or reproductive toxicity was observed in offspring of female Wistar Han rats when administered linagliptin from gestation day 6 to lactation day 21 at a dose 49 times the maximum recommended human dose, based on exposure.

Linagliptin crosses the placenta into the fetus following oral dosing in pregnant rats and rabbits.

### **8.3 Nursing Mothers**

No studies in lactating animals have been conducted with the combined components of GLYXAMBI.

Available animal data have shown excretion of empagliflozin and linagliptin in milk. It is not known whether empagliflozin and linagliptin are excreted in human milk. Empagliflozin is secreted in the milk of lactating rats reaching levels up to 5 times higher than that in maternal plasma. Since human kidney maturation occurs *in utero* and during the first 2 years of life when lactational exposure may occur, there may be risk to the developing human kidney. Because many drugs are excreted in human milk and because of the potential for serious adverse reactions in nursing infants from empagliflozin, a decision should be made whether to discontinue nursing or to discontinue GLYXAMBI, taking into account the importance of the drug to the mother.

### **8.4 Pediatric Use**

Safety and effectiveness of GLYXAMBI in pediatric patients under 18 years of age have not been established.

### **8.5 Geriatric Use**

#### *GLYXAMBI*

Empagliflozin is associated with osmotic diuresis, which could affect hydration status of patients age 75 years and older.

#### *Empagliflozin*

No empagliflozin dosage change is recommended based on age [*see Dosage and Administration (2)*]. A total of 2721 (32%) patients treated with empagliflozin were 65 years of age and older, and 491 (6%) were 75 years of age and older. Empagliflozin is expected to have diminished efficacy in elderly patients with renal impairment [*see Use in Specific Populations (8.6)*]. The risk of volume depletion-related adverse reactions increased in

patients who were 75 years of age and older to 2.1%, 2.3%, and 4.4% for placebo, empagliflozin 10 mg, and empagliflozin 25 mg. The risk of urinary tract infections increased in patients who were 75 years of age and older to 10.5%, 15.7%, and 15.1% in patients randomized to placebo, empagliflozin 10 mg, and empagliflozin 25 mg, respectively [see *Warnings and Precautions (5.2) and Adverse Reactions (6.1)*].

### *Linagliptin*

There were 4040 type 2 diabetes patients treated with linagliptin 5 mg from 15 clinical trials of linagliptin; 1085 (27%) were 65 years and over, while 131 (3%) were 75 years and over. Of these patients, 2566 were enrolled in 12 double-blind placebo-controlled studies; 591 (23%) were 65 years and over, while 82 (3%) were 75 years and over. No overall differences in safety or effectiveness were observed between patients 65 years and over and younger patients. Therefore, no dose adjustment is recommended in the elderly population. While clinical studies of linagliptin have not identified differences in response between the elderly and younger patients, greater sensitivity of some older individuals cannot be ruled out.

## **8.6 Renal Impairment**

### *Empagliflozin*

The efficacy and safety of empagliflozin have not been established in patients with severe renal impairment, with ESRD, or receiving dialysis. Empagliflozin is not expected to be effective in these patient populations [see *Dosage and Administration (2.2), Contraindications (4) and Warnings and Precautions (5.2, 5.3)*].

The glucose lowering benefit of empagliflozin 25 mg decreased in patients with worsening renal function. The risks of renal impairment [see *Warnings and Precautions (5.3)*], volume depletion adverse reactions and urinary tract infection-related adverse reactions increased with worsening renal function.

## **8.7 Hepatic Impairment**

GLYXAMBI may be used in patients with hepatic impairment [see *Clinical Pharmacology (12.3)*].

## **10 OVERDOSAGE**

In the event of an overdose with GLYXAMBI, contact the Poison Control Center. Employ the usual supportive measures (e.g., remove unabsorbed material from the gastrointestinal tract, employ clinical monitoring, and institute supportive treatment) as dictated by the patient's clinical status. Removal of empagliflozin by hemodialysis has not been studied, and removal of linagliptin by hemodialysis or peritoneal dialysis is unlikely.

## **11 DESCRIPTION**

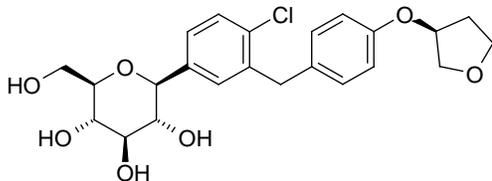
GLYXAMBI tablets contain two oral antihyperglycemic drugs used in the management of type 2 diabetes: empagliflozin and linagliptin.

### *Empagliflozin*

Empagliflozin is an orally-active inhibitor of the sodium-glucose co-transporter (SGLT2).

The chemical name of empagliflozin is D-Glucitol,1,5-anhydro-1-C-[4-chloro-3-[[4-[[[(3S)-tetrahydro-3-furanyl]oxy]phenyl]methyl]phenyl]-, (1S).

The molecular formula is  $C_{23}H_{27}ClO_7$  and the molecular weight is 450.91. The structural formula is:



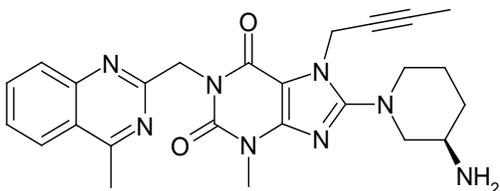
Empagliflozin is a white to yellowish, non-hygroscopic powder. It is very slightly soluble in water, sparingly soluble in methanol, slightly soluble in ethanol and acetonitrile; soluble in 50% acetonitrile/water; and practically insoluble in toluene.

### *Linagliptin*

Linagliptin is an orally-active inhibitor of the dipeptidyl peptidase-4 (DPP-4) enzyme.

The chemical name of linagliptin is 1H-Purine-2,6-dione, 8-[(3R)-3-amino-1-piperidiny]-7-(2-butyn-1-yl)-3,7-dihydro-3-methyl-1-[(4-methyl-2-quinazoliny)methyl]-

The molecular formula is  $C_{25}H_{28}N_8O_2$  and the molecular weight is 472.54. The structural formula is:



Linagliptin is a white to yellowish, not or only slightly hygroscopic solid substance. It is very slightly soluble in water. Linagliptin is soluble in methanol, sparingly soluble in ethanol, very slightly soluble in isopropanol, and very slightly soluble in acetone.

### *GLYXAMBI*

GLYXAMBI tablets for oral administration are available in two dosage strengths containing 10 mg or 25 mg empagliflozin in combination with 5 mg linagliptin. The inactive ingredients of GLYXAMBI are the following: Tablet Core: mannitol, pregelatinized starch, corn starch, copovidone, crospovidone, talc and magnesium stearate. Coating: hypromellose, mannitol, talc, titanium dioxide, polyethylene glycol and ferric oxide, yellow (10 mg/5 mg) or ferric oxide, red (25 mg/5 mg).

## **12 CLINICAL PHARMACOLOGY**

### **12.1 Mechanism of Action**

#### *GLYXAMBI*

GLYXAMBI combines 2 antihyperglycemic agents with complementary mechanisms of action to improve glycemic control in patients with type 2 diabetes: empagliflozin, a sodium-glucose co-transporter (SGLT2) inhibitor, and linagliptin, a dipeptidyl peptidase-4 (DPP-4) inhibitor.

#### *Empagliflozin*

Sodium-glucose co-transporter 2 (SGLT2) is the predominant transporter responsible for reabsorption of glucose from the glomerular filtrate back into the circulation. Empagliflozin is an inhibitor of SGLT2. By inhibiting SGLT2, empagliflozin reduces renal reabsorption of filtered glucose and lowers the renal threshold for glucose, and thereby increases urinary glucose excretion.

### *Linagliptin*

Linagliptin is an inhibitor of DPP-4, an enzyme that degrades the incretin hormones glucagon-like peptide-1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP). Thus, linagliptin increases the concentrations of active incretin hormones, stimulating the release of insulin in a glucose-dependent manner and decreasing the levels of glucagon in the circulation. Both incretin hormones are involved in the physiological regulation of glucose homeostasis. Incretin hormones are secreted at a low basal level throughout the day and levels rise immediately after meal intake. GLP-1 and GIP increase insulin biosynthesis and secretion from pancreatic beta cells in the presence of normal and elevated blood glucose levels. Furthermore, GLP-1 also reduces glucagon secretion from pancreatic alpha cells, resulting in a reduction in hepatic glucose output.

## **12.2 Pharmacodynamics**

### *Empagliflozin*

#### Urinary Glucose Excretion

In patients with type 2 diabetes, urinary glucose excretion increased immediately following a dose of empagliflozin and was maintained at the end of a 4-week treatment period averaging at approximately 64 grams per day with 10 mg empagliflozin and 78 grams per day with 25 mg empagliflozin once daily.

#### Urinary Volume

In a 5-day study, mean 24-hour urine volume increase from baseline was 341 mL on Day 1 and 135 mL on Day 5 of empagliflozin 25 mg once daily treatment.

#### Cardiac Electrophysiology

In a randomized, placebo-controlled, active-comparator, crossover study, 30 healthy subjects were administered a single oral dose of empagliflozin 25 mg, empagliflozin 200 mg (8 times the maximum recommended dose), moxifloxacin, and placebo. No increase in QTc was observed with either 25 mg or 200 mg empagliflozin.

### *Linagliptin*

Linagliptin binds to DPP-4 in a reversible manner and increases the concentrations of incretin hormones. Linagliptin glucose-dependently increases insulin secretion and lowers glucagon secretion, thus resulting in a better regulation of the glucose homeostasis. Linagliptin binds selectively to DPP-4 and selectively inhibits DPP-4, but not DPP-8 or DPP-9 activity *in vitro* at concentrations approximating therapeutic exposures.

#### Cardiac Electrophysiology

In a randomized, placebo-controlled, active-comparator, 4-way crossover study, 36 healthy subjects were administered a single oral dose of linagliptin 5 mg, linagliptin 100 mg (20 times the recommended dose), moxifloxacin, and placebo. No increase in QTc was observed with either the recommended dose of 5 mg or the 100-mg dose. At the 100-mg dose, peak linagliptin plasma concentrations were approximately 38-fold higher than the peak concentrations following a 5-mg dose.

## **12.3 Pharmacokinetics**

### *GLYXAMBI*

The results of the bioequivalence study in healthy subjects demonstrated that GLYXAMBI (25 mg empagliflozin/5 mg linagliptin) combination tablets are bioequivalent to coadministration of corresponding doses of empagliflozin and linagliptin as individual tablets. Administration of the fixed-dose combination with food resulted in no change in overall exposure of empagliflozin or linagliptin; however, the peak exposure was decreased 39% and 32% for empagliflozin and linagliptin, respectively. These changes are not likely to be clinically significant.

## *Absorption*

### Empagliflozin

The pharmacokinetics of empagliflozin has been characterized in healthy volunteers and patients with type 2 diabetes and no clinically relevant differences were noted between the two populations. After oral administration, peak plasma concentrations of empagliflozin were reached at 1.5 hours post-dose. Thereafter, plasma concentrations declined in a biphasic manner with a rapid distribution phase and a relatively slow terminal phase. The steady state mean plasma AUC and  $C_{max}$  were 1870 nmol·h/L and 259 nmol/L, respectively, with 10 mg empagliflozin once daily treatment, and 4740 nmol·h/L and 687 nmol/L, respectively, with 25 mg empagliflozin once daily treatment. Systemic exposure of empagliflozin increased in a dose-proportional manner in the therapeutic dose range. The single-dose and steady-state pharmacokinetic parameters of empagliflozin were similar, suggesting linear pharmacokinetics with respect to time.

Administration of 25 mg empagliflozin after intake of a high-fat and high-calorie meal resulted in slightly lower exposure; AUC decreased by approximately 16% and  $C_{max}$  decreased by approximately 37%, compared to fasted condition. The observed effect of food on empagliflozin pharmacokinetics was not considered clinically relevant and empagliflozin may be administered with or without food.

### Linagliptin

The absolute bioavailability of linagliptin is approximately 30%. High-fat meal reduced  $C_{max}$  by 15% and increased AUC by 4%; this effect is not clinically relevant. Linagliptin may be administered with or without food.

## *Distribution*

### Empagliflozin

The apparent steady-state volume of distribution was estimated to be 73.8 L based on a population pharmacokinetic analysis. Following administration of an oral [ $^{14}$ C]-empagliflozin solution to healthy subjects, the red blood cell partitioning was approximately 36.8% and plasma protein binding was 86.2%.

### Linagliptin

The mean apparent volume of distribution at steady state following a single intravenous dose of linagliptin 5 mg to healthy subjects is approximately 1110 L, indicating that linagliptin extensively distributes to the tissues. Plasma protein binding of linagliptin is concentration-dependent, decreasing from about 99% at 1 nmol/L to 75% to 89% at  $\geq 30$  nmol/L, reflecting saturation of binding to DPP-4 with increasing concentration of linagliptin. At high concentrations, where DPP-4 is fully saturated, 70% to 80% of linagliptin remains bound to plasma proteins and 20% to 30% is unbound in plasma. Plasma binding is not altered in patients with renal or hepatic impairment.

## *Metabolism*

### Empagliflozin

No major metabolites of empagliflozin were detected in human plasma and the most abundant metabolites were three glucuronide conjugates (2-O-, 3-O-, and 6-O-glucuronide). Systemic exposure of each metabolite was less than 10% of total drug-related material. *In vitro* studies suggested that the primary route of metabolism of empagliflozin in humans is glucuronidation by the uridine 5'-diphospho-glucuronosyltransferases UGT2B7, UGT1A3, UGT1A8, and UGT1A9.

### Linagliptin

Following oral administration, the majority (about 90%) of linagliptin is excreted unchanged, indicating that metabolism represents a minor elimination pathway. A small fraction of absorbed linagliptin is metabolized to a pharmacologically inactive metabolite, which shows a steady-state exposure of 13.3% relative to linagliptin.

## *Elimination*

### Empagliflozin

The apparent terminal elimination half-life of empagliflozin was estimated to be 12.4 h and apparent oral clearance was 10.6 L/h based on the population pharmacokinetic analysis. Following once-daily dosing, up to 22% accumulation, with respect to plasma AUC, was observed at steady-state, which was consistent with empagliflozin half-life. Following administration of an oral [<sup>14</sup>C]-empagliflozin solution to healthy subjects, approximately 95.6% of the drug-related radioactivity was eliminated in feces (41.2%) or urine (54.4%). The majority of drug-related radioactivity recovered in feces was unchanged parent drug and approximately half of drug-related radioactivity excreted in urine was unchanged parent drug.

### Linagliptin

Following administration of an oral [<sup>14</sup>C]-linagliptin dose to healthy subjects, approximately 85% of the administered radioactivity was eliminated via the enterohepatic system (80%) or urine (5%) within 4 days of dosing. Renal clearance at steady state was approximately 70 mL/min.

## *Specific Populations*

### Renal Impairment

**GLYXAMBI:** Studies characterizing the pharmacokinetics of empagliflozin and linagliptin after administration of GLYXAMBI in renally impaired patients have not been performed [*see Dosage and Administration (2.2)*].

**Empagliflozin:** In patients with mild (eGFR: 60 to less than 90 mL/min/1.73 m<sup>2</sup>), moderate (eGFR: 30 to less than 60 mL/min/1.73 m<sup>2</sup>), and severe (eGFR: less than 30 mL/min/1.73 m<sup>2</sup>) renal impairment and subjects with kidney failure/end stage renal disease (ESRD) patients, AUC of empagliflozin increased by approximately 18%, 20%, 66%, and 48%, respectively, compared to subjects with normal renal function. Peak plasma levels of empagliflozin were similar in subjects with moderate renal impairment and kidney failure/ESRD compared to patients with normal renal function. Peak plasma levels of empagliflozin were roughly 20% higher in subjects with mild and severe renal impairment as compared to subjects with normal renal function. Population pharmacokinetic analysis showed that the apparent oral clearance of empagliflozin decreased, with a decrease in eGFR leading to an increase in drug exposure. However, the fraction of empagliflozin that was excreted unchanged in urine, and urinary glucose excretion, declined with decrease in eGFR.

**Linagliptin:** An open-label pharmacokinetic study evaluated the pharmacokinetics of linagliptin 5 mg in male and female patients with varying degrees of chronic renal impairment. The study included 6 healthy subjects with normal renal function (creatinine clearance [CrCl] ≥80 mL/min), 6 patients with mild renal impairment (CrCl 50 to <80 mL/min), 6 patients with moderate renal impairment (CrCl 30 to <50 mL/min), 10 patients with type 2 diabetes and severe renal impairment (CrCl <30 mL/min), and 11 patients with type 2 diabetes and normal renal function. Creatinine clearance was measured by 24-hour urinary creatinine clearance measurements or estimated from serum creatinine based on the Cockcroft-Gault formula.

Under steady-state conditions, linagliptin exposure in patients with mild renal impairment was comparable to healthy subjects.

In patients with moderate renal impairment under steady-state conditions, mean exposure of linagliptin increased (AUC<sub>τ,ss</sub> by 71% and C<sub>max</sub> by 46%) compared with healthy subjects. This increase was not associated with a prolonged accumulation half-life, terminal half-life, or an increased accumulation factor. Renal excretion of linagliptin was below 5% of the administered dose and was not affected by decreased renal function. Patients with type 2 diabetes and severe renal impairment showed steady-state exposure approximately 40% higher than that of patients with type 2 diabetes and normal renal function (increase in AUC<sub>τ,ss</sub> by 42% and C<sub>max</sub> by 35%). For both type 2 diabetes groups, renal excretion was below 7% of the administered dose.

These findings were further supported by the results of population pharmacokinetic analyses.

### Hepatic Impairment

*GLYXAMBI*: Studies characterizing the pharmacokinetics of empagliflozin and linagliptin after administration of GLYXAMBI in hepatically impaired patients have not been performed.

*Empagliflozin*: In subjects with mild, moderate, and severe hepatic impairment according to the Child-Pugh classification, AUC of empagliflozin increased by approximately 23%, 47%, and 75% and  $C_{\max}$  increased by approximately 4%, 23%, and 48%, respectively, compared to subjects with normal hepatic function.

*Linagliptin*: In patients with mild hepatic impairment (Child-Pugh class A) steady-state exposure ( $AUC_{\tau,ss}$ ) of linagliptin was approximately 25% lower and  $C_{\max,ss}$  was approximately 36% lower than in healthy subjects. In patients with moderate hepatic impairment (Child-Pugh class B),  $AUC_{ss}$  of linagliptin was about 14% lower and  $C_{\max,ss}$  was approximately 8% lower than in healthy subjects. Patients with severe hepatic impairment (Child-Pugh class C) had comparable exposure of linagliptin in terms of  $AUC_{0-24}$  and approximately 23% lower  $C_{\max}$  compared with healthy subjects. Reductions in the pharmacokinetic parameters seen in patients with hepatic impairment did not result in reductions in DPP-4 inhibition.

### Effects of Age, Body Mass Index, Gender, and Race

*Empagliflozin*: Based on the population PK analysis, age, body mass index (BMI), gender and race (Asians versus primarily Whites) do not have a clinically meaningful effect on pharmacokinetics of empagliflozin [see *Use in Specific Populations (8.5)*].

*Linagliptin*: Based on the population PK analysis, age, body mass index (BMI), gender and race do not have a clinically meaningful effect on pharmacokinetics of linagliptin [see *Use in Specific Populations (8.5)*].

### Pediatric

Studies characterizing the pharmacokinetics of empagliflozin or linagliptin after administration of GLYXAMBI in pediatric patients have not been performed.

### *Drug Interactions*

Pharmacokinetic drug interaction studies with GLYXAMBI have not been performed; however, such studies have been conducted with the individual components of GLYXAMBI (empagliflozin and linagliptin).

### *Empagliflozin*

#### *In vitro* Assessment of Drug Interactions

*In vitro* data suggest that the primary route of metabolism of empagliflozin in humans is glucuronidation by the uridine 5'-diphospho-glucuronosyltransferases UGT2B7, UGT1A3, UGT1A8, and UGT1A9. Empagliflozin does not inhibit, inactivate, or induce CYP450 isoforms. Empagliflozin also does not inhibit UGT1A1.

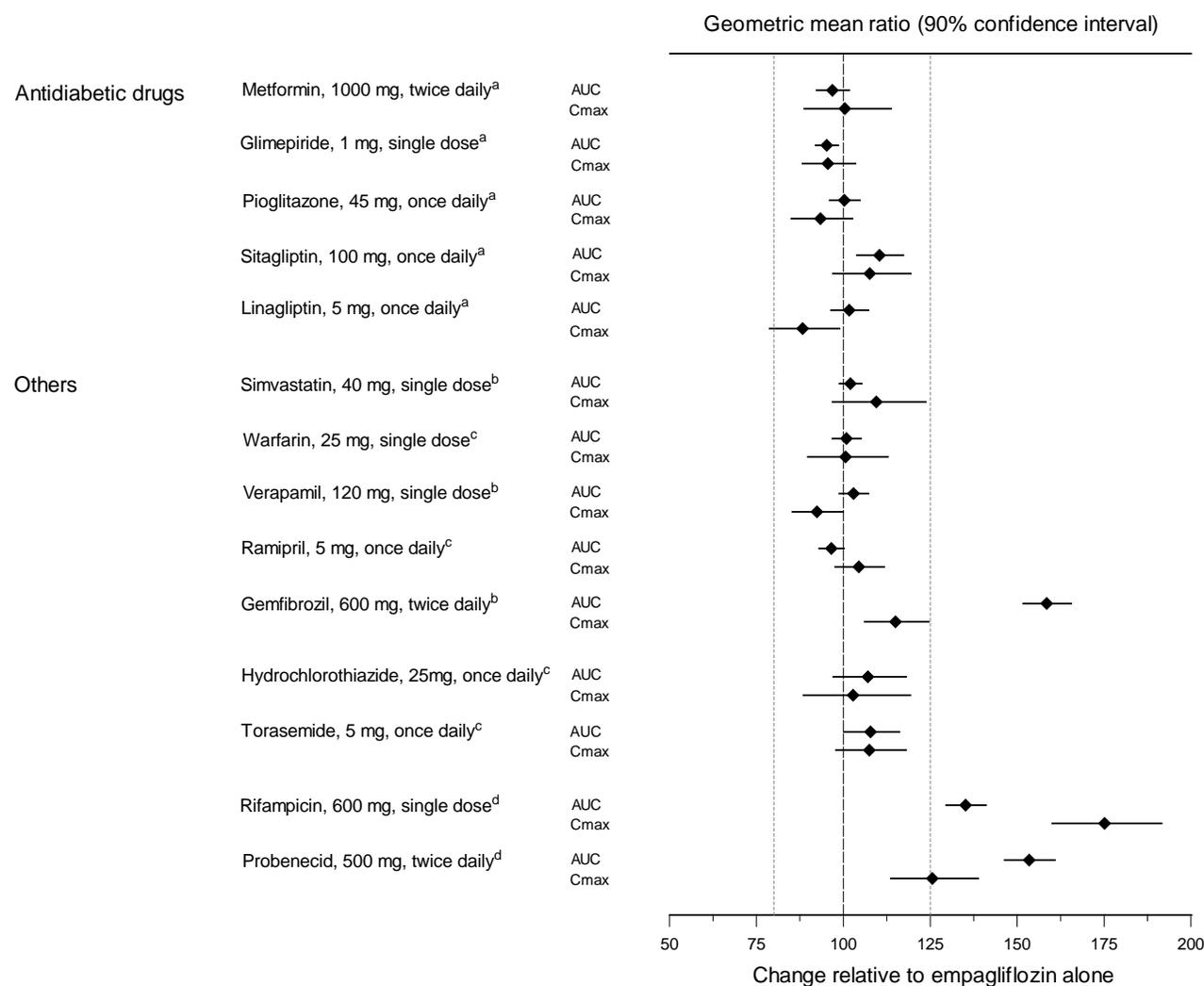
Therefore, no effect of empagliflozin is anticipated on concomitantly administered drugs that are substrates of the major CYP450 isoforms or UGT1A1. The effect of UGT induction (e.g., induction by rifampicin or any other UGT enzyme inducer) on empagliflozin exposure has not been evaluated.

Empagliflozin is a substrate for P-glycoprotein (P-gp) and breast cancer resistance protein (BCRP), but it does not inhibit these efflux transporters at therapeutic doses. Based on *in vitro* studies, empagliflozin is considered unlikely to cause interactions with drugs that are P-gp substrates. Empagliflozin is a substrate of the human uptake transporters OAT3, OATP1B1, and OATP1B3, but not OAT1 and OCT2. Empagliflozin does not inhibit any of these human uptake transporters at clinically relevant plasma concentrations and, therefore, no effect of empagliflozin is anticipated on concomitantly administered drugs that are substrates of these uptake transporters.

### In vivo Assessment of Drug Interactions

No dose adjustment of empagliflozin is recommended when coadministered with commonly prescribed medicinal products based on results of the described pharmacokinetic studies. Empagliflozin pharmacokinetics were similar with and without coadministration of metformin, glimepiride, pioglitazone, sitagliptin, linagliptin, warfarin, verapamil, ramipril, simvastatin, hydrochlorothiazide, and torasemide in healthy volunteers (see Figure 1). The observed increases in overall exposure (AUC) of empagliflozin following coadministration with gemfibrozil, rifampicin, or probenecid are not clinically relevant. In subjects with normal renal function, coadministration of empagliflozin with probenecid resulted in a 30% decrease in the fraction of empagliflozin excreted in urine without any effect on 24-hour urinary glucose excretion. The relevance of this observation to patients with renal impairment is unknown.

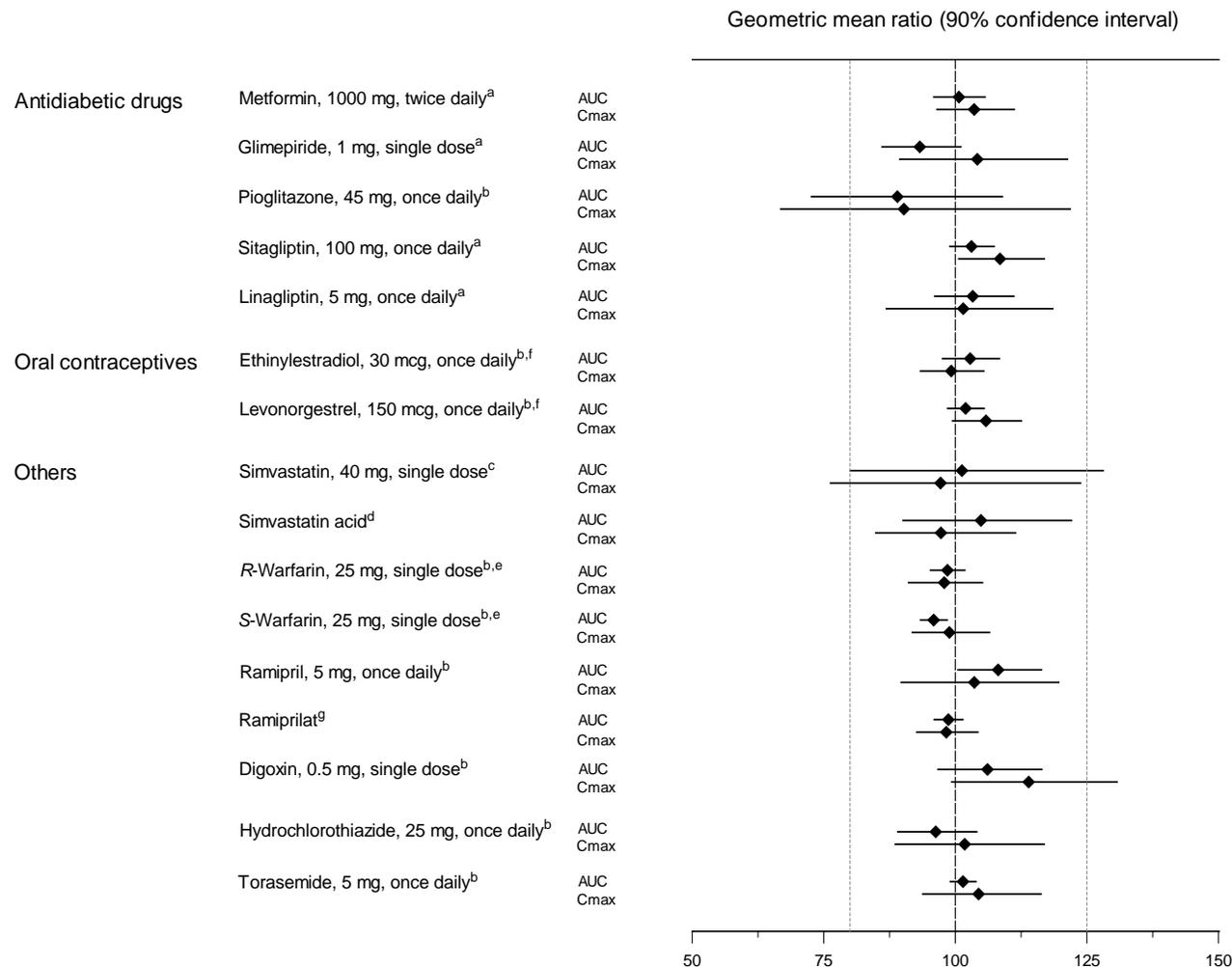
**Figure 1 Effect of Various Medications on the Pharmacokinetics of Empagliflozin as Displayed as 90% Confidence Interval of Geometric Mean AUC and C<sub>max</sub> Ratios [reference lines indicate 100% (80% - 125%)]**



<sup>a</sup>empagliflozin, 50 mg, once daily; <sup>b</sup>empagliflozin, 25 mg, single dose; <sup>c</sup>empagliflozin, 25 mg, once daily; <sup>d</sup>empagliflozin, 10 mg, single dose

Empagliflozin had no clinically relevant effect on the pharmacokinetics of metformin, glimepiride, pioglitazone, sitagliptin, linagliptin, warfarin, digoxin, ramipril, simvastatin, hydrochlorothiazide, torasemide, and oral contraceptives when coadministered in healthy volunteers (see Figure 2).

**Figure 2 Effect of Empagliflozin on the Pharmacokinetics of Various Medications as Displayed as 90% Confidence Interval of Geometric Mean AUC and C<sub>max</sub> Ratios [reference lines indicate 100% (80% - 125%)]**



<sup>a</sup>empagliflozin, 50 mg, once daily; <sup>b</sup>empagliflozin, 25 mg, once daily; <sup>c</sup>empagliflozin, 25 mg, single dose; <sup>d</sup>administered as simvastatin; <sup>e</sup>administered as warfarin racemic mixture; <sup>f</sup>administered as Microgynon®; <sup>g</sup>administered as ramipril

### Linagliptin

#### In vitro Assessment of Drug Interactions

Linagliptin is a weak to moderate inhibitor of CYP isozyme CYP3A4, but does not inhibit other CYP isozymes and is not an inducer of CYP isozymes, including CYP1A2, 2A6, 2B6, 2C8, 2C9, 2C19, 2D6, 2E1, and 4A11.

Linagliptin is a P-glycoprotein (P-gp) substrate, and inhibits P-gp mediated transport of digoxin at high concentrations. Based on these results and *in vivo* drug interaction studies, linagliptin is considered unlikely to cause interactions with other P-gp substrates at therapeutic concentrations.

### In vivo Assessment of Drug Interactions

Strong inducers of CYP3A4 or P-gp (e.g., rifampin) decrease exposure to linagliptin to subtherapeutic and likely ineffective concentrations. For patients requiring use of such drugs, an alternative to linagliptin is strongly recommended. *In vivo* studies indicated evidence of a low propensity for causing drug interactions with substrates of CYP3A4, CYP2C9, CYP2C8, P-gp and organic cationic transporter (OCT). No dose adjustment of linagliptin is recommended based on results of the described pharmacokinetic studies.

**Table 3 Effect of Coadministered Drugs on Systemic Exposure of Linagliptin**

Coadministered Drug	Dosing of Coadministered Drug <sup>a</sup>	Dosing of Linagliptin <sup>a</sup>	Geometric Mean Ratio (ratio with/without coadministered drug) No effect = 1.0	
			AUC <sup>c</sup>	Cmax
<b>No dosing adjustments required for linagliptin when given with the following coadministered drugs:</b>				
Metformin	850 mg TID	10 mg QD	1.20	1.03
Glyburide	1.75 mg <sup>b</sup>	5 mg QD	1.02	1.01
Pioglitazone	45 mg QD	10 mg QD	1.13	1.07
Ritonavir	200 mg BID	5 mg <sup>b</sup>	2.01	2.96
<b>The efficacy of linagliptin may be reduced when administered in combination with strong inducers of CYP3A4 or P-gp (e.g., rifampin). Use of alternative treatments is strongly recommended [see Drug Interactions (7.2)].</b>				
Rifampin	600 mg QD	5 mg QD	0.60	0.56

<sup>a</sup>Multiple dose (steady state) unless otherwise noted

<sup>b</sup>Single dose

<sup>c</sup>AUC = AUC(0 to 24 hours) for single dose treatments and AUC = AUC(TAU) for multiple dose treatments

QD = once daily

BID = twice daily

TID = three times daily

**Table 4 Effect of Linagliptin on Systemic Exposure of Coadministered Drugs**

Coadministered Drug	Dosing of Coadministered Drug <sup>a</sup>	Dosing of Linagliptin <sup>a</sup>	Geometric Mean Ratio (ratio with/without coadministered drug) No effect = 1.0		
				AUC <sup>c</sup>	Cmax
<b>No dosing adjustments required for the following coadministered drugs:</b>					
Metformin	850 mg TID	10 mg QD	metformin	1.01	0.89
Glyburide	1.75 mg <sup>b</sup>	5 mg QD	glyburide	0.86	0.86
Pioglitazone	45 mg QD	10 mg QD	pioglitazone	0.94	0.86
			metabolite M-III	0.98	0.96
			metabolite M-IV	1.04	1.05
Digoxin	0.25 mg QD	5 mg QD	digoxin	1.02	0.94
Simvastatin	40 mg QD	10 mg QD	simvastatin	1.34	1.10
			simvastatin acid	1.33	1.21
Warfarin	10 mg <sup>b</sup>	5 mg QD	R-warfarin	0.99	1.00
			S-warfarin	1.03	1.01
			INR	0.93 <sup>d</sup>	1.04 <sup>d</sup>
			PT	1.03 <sup>d</sup>	1.15 <sup>d</sup>
Ethinylestradiol and levonorgestrel	ethinylestradiol 0.03 mg and levonorgestrel 0.150 mg QD	5 mg QD	ethinylestradiol	1.01	1.08
			levonorgestrel	1.09	1.13

<sup>a</sup>Multiple dose (steady state) unless otherwise noted

<sup>b</sup>Single dose

<sup>c</sup>AUC = AUC(INF) for single dose treatments and AUC = AUC(TAU) for multiple dose treatments

<sup>d</sup>AUC=AUC(0-168) and Cmax=Emax for pharmacodynamic end points

INR = International Normalized Ratio  
PT = Prothrombin Time  
QD = once daily  
TID = three times daily

## 13 NONCLINICAL TOXICOLOGY

### 13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

#### GLYXAMBI

No animal studies have been conducted with the combination of empagliflozin and linagliptin to evaluate carcinogenesis, mutagenesis, or impairment of fertility. General toxicity studies in rats up to 13 weeks were performed with the combined components. These studies indicated that no additive toxicity is caused by the combination of empagliflozin and linagliptin.

#### *Empagliflozin*

Carcinogenesis was evaluated in 2-year studies conducted in CD-1 mice and Wistar rats. Empagliflozin did not increase the incidence of tumors in female rats dosed at 100, 300, or 700 mg/kg/day (up to 72 times the exposure from the maximum clinical dose of 25 mg). In male rats, hemangiomas of the mesenteric lymph node were increased significantly at 700 mg/kg/day or approximately 42 times the exposure from a 25 mg clinical dose. Empagliflozin did not increase the incidence of tumors in female mice dosed at 100, 300, or 1000 mg/kg/day (up to 62 times the exposure from a 25 mg clinical dose). Renal tubule adenomas and carcinomas were observed in male mice at 1000 mg/kg/day, which is approximately 45 times the exposure of the maximum clinical dose of 25 mg.

Empagliflozin was not mutagenic or clastogenic with or without metabolic activation in the *in vitro* Ames bacterial mutagenicity assay, the *in vitro* L5178Y tk<sup>+/−</sup> mouse lymphoma cell assay, and an *in vivo* micronucleus assay in rats.

Empagliflozin had no effects on mating, fertility or early embryonic development in treated male or female rats up to the high dose of 700 mg/kg/day (approximately 155 times the 25 mg clinical dose in males and females, respectively).

#### *Linagliptin*

Linagliptin did not increase the incidence of tumors in male and female rats in a 2-year study at doses of 6, 18, and 60 mg/kg. The highest dose of 60 mg/kg is approximately 418 times the clinical dose of 5 mg/day based on AUC exposure. Linagliptin did not increase the incidence of tumors in mice in a 2-year study at doses up to 80 mg/kg (males) and 25 mg/kg (females), or approximately 35- and 270-times the clinical dose based on AUC exposure. Higher doses of linagliptin in female mice (80 mg/kg) increased the incidence of lymphoma at approximately 215-times the clinical dose based on AUC exposure.

Linagliptin was not mutagenic or clastogenic with or without metabolic activation in the Ames bacterial mutagenicity assay, a chromosomal aberration test in human lymphocytes, and an *in vivo* micronucleus assay.

In fertility studies in rats, linagliptin had no adverse effects on early embryonic development, mating, fertility, or bearing live young up to the highest dose of 240 mg/kg (approximately 943-times the clinical dose based on AUC exposure).

## 14 CLINICAL STUDIES

### *Add-on Combination Therapy with Metformin*

A total of 686 patients with type 2 diabetes participated in a double-blind, active-controlled study to evaluate the efficacy and safety of empagliflozin 10 mg or 25 mg in combination with linagliptin 5 mg compared to the individual components.

Patients with type 2 diabetes inadequately controlled on at least 1500 mg of metformin per day entered a single-blind placebo run-in period for 2 weeks. At the end of the run-in period, patients who remained inadequately controlled and had an HbA1c between 7 and 10.5% were randomized 1:1:1:1:1 to one of 5 active-treatment arms of empagliflozin 10 mg or 25 mg, linagliptin 5 mg, or linagliptin 5 mg in combination with 10 mg or 25 mg empagliflozin as a fixed dose combination tablet.

At Week 24, empagliflozin 10 mg or 25 mg used in combination with linagliptin 5 mg provided statistically significant improvement in HbA1c (p-value <0.0001) and FPG (p-value <0.001) compared to the individual components in patients who had been inadequately controlled on metformin (see Table 5, Figure 3). Treatment with GLYXAMBI 25 mg/5 mg or GLYXAMBI 10 mg/5 mg daily also resulted in a statistically significant reduction in body weight compared to linagliptin 5 mg (p-value <0.0001). There was no statistically significant difference compared to empagliflozin alone.

**Table 5 Glycemic Parameters at 24 Weeks in a Study Comparing GLYXAMBI to the Individual Components as Add-on Therapy in Patients Inadequately Controlled on Metformin**

	<b>GLYXAMBI 10 mg/5 mg</b>	<b>GLYXAMBI 25 mg/5 mg</b>	<b>Empagliflozin 10 mg</b>	<b>Empagliflozin 25 mg</b>	<b>Linagliptin 5 mg</b>
<b>HbA1c (%)</b>					
Number of patients	n=135	n=133	n=137	n=139	n=128
Baseline (mean)	8.0	7.9	8.0	8.0	8.0
Change from baseline (adjusted mean)	-1.1	-1.2	-0.7	-0.6	-0.7
Comparison vs empagliflozin 25 mg or 10 mg (adjusted mean) (95% CI) <sup>a</sup>	-0.4 (-0.6, -0.2) <sup>d</sup>	-0.6 (-0.7, -0.4) <sup>d</sup>	--	--	--
Comparison vs linagliptin 5 mg (adjusted mean) (95% CI) <sup>a</sup>	-0.4 (-0.6, -0.2) <sup>d</sup>	-0.5 (-0.7, -0.3) <sup>d</sup>	--	--	--
Patients [n (%)] achieving HbA1c <7% <sup>b</sup>	74 (58)	76 (62)	35 (28)	43 (33)	43 (36)
<b>FPG (mg/dL)</b>					
Number of patients	n=133	n=131	n=136	n=137	n=125
Baseline (mean)	157	155	162	160	156
Change from baseline (adjusted mean)	-33	-36	-21	-21	-13
Comparison vs empagliflozin 25 mg or 10 mg (adjusted mean) (95% CI) <sup>a</sup>	-12 (-18, -5) <sup>d</sup>	-15 (-22, -9) <sup>d</sup>	--	--	--
Comparison vs linagliptin 5 mg (adjusted mean) (95% CI) <sup>a</sup>	-20 (-27, -13) <sup>d</sup>	-23 (-29, -16) <sup>d</sup>	--	--	--
<b>Body Weight</b>					
Number of patients	n=135	n=134	n=137	n=140	n=128
Baseline (mean) in kg	87	85	86	88	85
% change from baseline (adjusted mean)	-3.1	-3.4	-3.0	-3.5	-0.7
Comparison vs empagliflozin 25 mg or 10 mg (adjusted mean) (95% CI) <sup>c</sup>	0.0 (-0.9, 0.8)	0.1 (-0.8, 0.9)	--	--	--
Comparison vs linagliptin 5 mg (adjusted mean) (95% CI) <sup>c</sup>	-2.4 (-3.3, -1.5) <sup>d</sup>	-2.7 (-3.6, -1.8) <sup>d</sup>	--	--	--

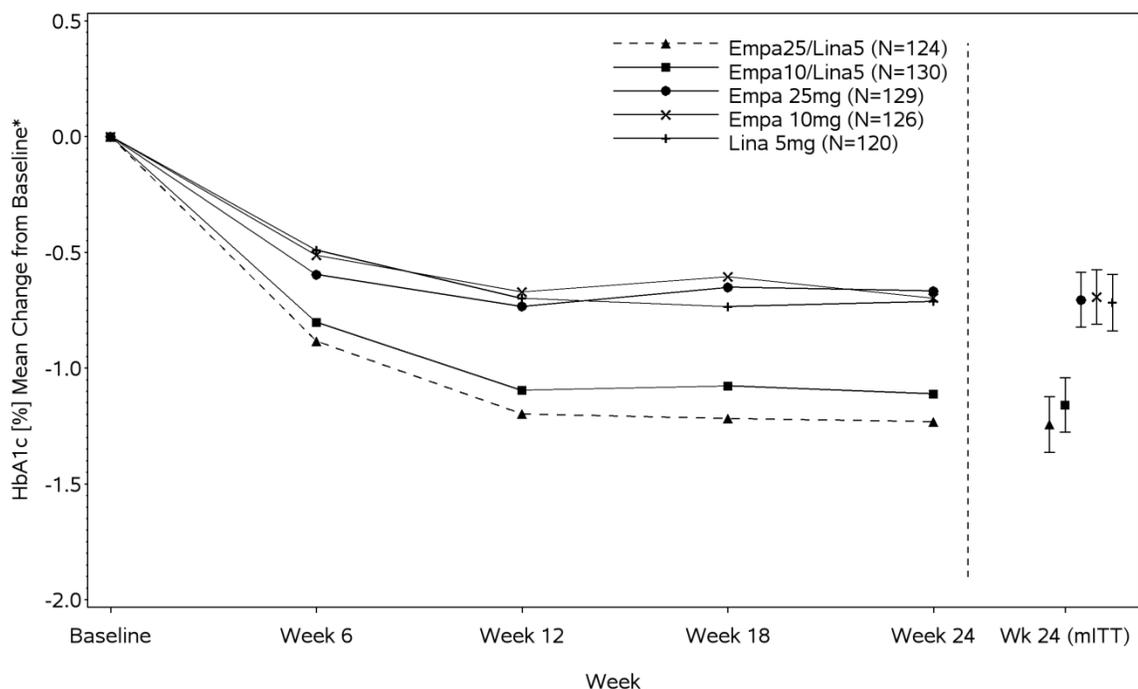
<sup>a</sup>Full analysis population (observed case) using MMRM. MMRM model included treatment, renal function, region, visit, visit by treatment interaction, and baseline HbA1c.

<sup>b</sup>Patients with HbA1c above 7% at baseline: GLYXAMBI 25 mg/5 mg, n=123; GLYXAMBI 10 mg/5 mg, n=128; empagliflozin 25 mg, n=132; empagliflozin 10 mg, n=125; linagliptin 5 mg, n=119. Non-completers were considered failures (NCF).

<sup>c</sup>Full analysis population using last observation carried forward. ANCOVA model included treatment, renal function, region, baseline weight, and baseline HbA1c.

<sup>d</sup>p<0.001 for FPG; p<0.0001 for HbA1c and body weight

**Figure 3 Adjusted Mean HbA1c Change at Each Time Point (Completers) and at Week 24 (mITT population)**



\*Mean change from baseline adjusted for baseline HbA1c, geographical region, and eGFR at baseline.

## 16 HOW SUPPLIED/STORAGE AND HANDLING

GLYXAMBI (empagliflozin and linagliptin) tablets are available in 10 mg/5 mg and 25 mg/5 mg strengths as follows:

**10 mg/5 mg tablets:** pale yellow, arc triangular, flat-faced, bevel-edged, film-coated tablets. One side is debossed with the Boehringer Ingelheim company symbol; the other side is debossed with "10/5".

Bottles of 30 (NDC 0597-0182-30)

Bottles of 90 (NDC 0597-0182-90)

Bottles of 1000 (NDC 0597-0182-10)

Cartons containing 3 blister cards of 10 tablets each (3 x 10) (NDC 0597-0182-39), institutional pack.

**25 mg/5 mg tablets:** pale pink, arc triangular, flat-faced, bevel-edged, film-coated tablets. One side is debossed with the Boehringer Ingelheim company symbol; the other side is debossed with "25/5".

Bottles of 30 (NDC 0597-0164-30)

Bottles of 90 (NDC 0597-0164-90)

Bottles of 1000 (NDC 0597-0164-10)

Cartons containing 3 blister cards of 10 tablets each (3 x 10) (NDC 0597-0164-39), institutional pack.

If repackaging is required, dispense in a tight container as defined in USP.

### Storage

**Store at 25°C (77°F); excursions permitted to 15°-30°C (59°-86°F)** [see USP Controlled Room Temperature]. Store in a safe place out of reach of children.

## 17 PATIENT COUNSELING INFORMATION

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

### Instructions

Instruct patients to read the Medication Guide before starting GLYXAMBI therapy and to reread it each time the prescription is renewed. Instruct patients to inform their doctor or pharmacist if they develop any unusual symptom, or if any known symptom persists or worsens.

Inform patients of the potential risks and benefits of GLYXAMBI and of alternative modes of therapy. Also, inform patients about the importance of adherence to dietary instructions, regular physical activity, periodic blood glucose monitoring and HbA1c testing, recognition and management of hypoglycemia and hyperglycemia, and assessment for diabetes complications. Advise patients to seek medical advice promptly during periods of stress such as fever, trauma, infection, or surgery, as medication requirements may change.

Instruct patients to take GLYXAMBI only as prescribed. If a dose is missed, it should be taken as soon as the patient remembers. Advise patients not to double their next dose.

Inform female patients of child bearing age that the use of GLYXAMBI during pregnancy has not been studied in humans, and that GLYXAMBI should only be used during pregnancy only if the potential benefit justifies the potential risk to the fetus. Based on animal data, empagliflozin may cause fetal harm in the second and third trimesters. Instruct patients to report pregnancies to their physicians as soon as possible.

Inform nursing mothers to discontinue GLYXAMBI or nursing, taking into account the important of the drug to the mother. It is not known if empagliflozin or linagliptin is excreted in breast milk; however, based on animal data, empagliflozin may cause harm to nursing infants.

### Pancreatitis

Inform patients that acute pancreatitis has been reported during postmarketing use of linagliptin. Inform patients that persistent severe abdominal pain, sometimes radiating to the back, which may or may not be accompanied by vomiting, is the hallmark symptom of acute pancreatitis. Instruct patients to discontinue GLYXAMBI promptly and contact their physician if persistent severe abdominal pain occurs [*see Warnings and Precautions (5.1)*].

### Hypoglycemia

Inform patients that the incidence of hypoglycemia is increased when empagliflozin, linagliptin, or GLYXAMBI is added to a sulfonylurea or insulin and that a lower dose of the sulfonylurea or insulin may be required to reduce the risk of hypoglycemia.

### Hypersensitivity Reactions

Inform patients that serious allergic reactions, such as anaphylaxis, angioedema, and exfoliative skin conditions, have been reported during postmarketing use of linagliptin (one of the components of GLYXAMBI). If symptoms of allergic reactions (such as rash, skin flaking or peeling, urticaria, swelling of the skin, or swelling of the face, lips, tongue, and throat that may cause difficulty in breathing or swallowing) occur, patients must stop taking GLYXAMBI and seek medical advice promptly.

### Hypotension

Inform patients that hypotension may occur with GLYXAMBI and advise them to contact their healthcare provider if they experience such symptoms [*see Warnings and Precautions (5.2)*]. Inform patients that dehydration may increase the risk for hypotension, and to have adequate fluid intake.

### Urinary Tract Infections

Inform patients of the potential for urinary tract infections. Provide them with information on the symptoms of urinary tract infections. Advise them to seek medical advice if such symptoms occur.

### Genital Mycotic Infections in Females (e.g., Vulvovaginitis)

Inform female patients that vaginal yeast infections may occur and provide them with information on the signs and symptoms of vaginal yeast infections. Advise them of treatment options and when to seek medical advice [see *Warnings and Precautions (5.5)*].

### Genital Mycotic Infections in Males (e.g., Balanitis or Balanoposthitis)

Inform male patients that yeast infection of penis (e.g., balanitis or balanoposthitis) may occur, especially in uncircumcised males and patients with chronic and recurrent infections. Provide them with information on the signs and symptoms of balanitis and balanoposthitis (rash or redness of the glans or foreskin of the penis). Advise them of treatment options and when to seek medical advice [see *Warnings and Precautions (5.5)*].

### Laboratory Tests

Inform patients that renal function should be assessed prior to initiation of GLYXAMBI and monitored periodically thereafter.

Inform patients that elevated glucose in urinalysis is expected when taking GLYXAMBI.

Inform patients that response to all diabetic therapies should be monitored by periodic measurements of blood glucose and HbA1c levels, with a goal of decreasing these levels toward the normal range. Hemoglobin A1c is especially useful for evaluating long-term glycemic control.

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**MEDICATION GUIDE**  
**GLYXAMBI (glik-SAM-bee)**  
**(empagliflozin and linagliptin)**  
**Tablets**

Read this Medication Guide carefully before you start taking GLYXAMBI and each time you get a refill. There may be new information. This information does not take the place of talking to your doctor about your medical condition or your treatment. If you have any questions about GLYXAMBI, ask your doctor or pharmacist.

**What is the most important information I should know about GLYXAMBI?**

**Serious side effects can happen to people taking GLYXAMBI**, including:

- **Inflammation of the pancreas (pancreatitis)** which may be severe and lead to death. Certain medical problems make you more likely to get pancreatitis.

**Before you start taking GLYXAMBI, tell your doctor if you have ever had:**

- inflammation of your pancreas (pancreatitis)
- stones in your gallbladder (gallstones)
- a history of alcoholism
- high blood triglyceride levels

Stop taking GLYXAMBI and call your doctor right away if you have pain in your stomach area (abdomen) that is severe and will not go away. The pain may be felt going from your abdomen to your back. The pain may happen with or without vomiting. These may be symptoms of pancreatitis.

- **Dehydration.** GLYXAMBI can cause some people to have dehydration (the loss of body water and salt). Dehydration may cause you to feel dizzy, faint, light-headed, or weak, especially when you stand up (orthostatic hypotension).

You may be at higher risk of dehydration if you:

- have low blood pressure
- take medicines to lower your blood pressure, including diuretics (water pill)
- are on low sodium (salt) diet
- have kidney problems
- are 65 years of age or older

- **Vaginal yeast infection.** Women who take GLYXAMBI may get vaginal yeast infections. Symptoms of a vaginal yeast infection include:

- vaginal odor
- white or yellowish vaginal discharge (discharge may be lumpy or look like cottage cheese)
- vaginal itching

- **Yeast infection of the penis (balanitis or balanoposthitis).** Men who take GLYXAMBI may get a yeast infection of the skin around the penis. Men who are not circumcised may have swelling of the penis that makes it difficult to pull back the skin around the tip of the penis. Other symptoms of yeast infection of the penis include:

- redness, itching, or swelling of the penis
- rash of the penis
- foul smelling discharge from the penis

- pain in the skin around penis

Talk to your doctor about what to do if you get symptoms of a yeast infection of the vagina or penis. Your doctor may tell you to use an over-the-counter antifungal medicine. Talk to your doctor right away if you use an over-the-counter antifungal medicine and your symptoms do not go away.

### **What is GLYXAMBI?**

GLYXAMBI is a prescription medicine that contains 2 diabetes medicines, empagliflozin (JARDIANCE) and linagliptin (TRADJENTA). GLYXAMBI can be used along with diet and exercise to lower blood sugar in adults with type 2 diabetes when treatment with both empagliflozin (JARDIANCE) and linagliptin (TRADJENTA) is appropriate.

- GLYXAMBI is not for people with type 1 diabetes.
- GLYXAMBI is not for people with diabetic ketoacidosis (increased ketones in the blood or urine).
- If you have had pancreatitis in the past, it is not known if you have a higher chance of getting pancreatitis while you take GLYXAMBI.

It is not known if GLYXAMBI is safe and effective in children under 18 years of age.

### **Who should not take GLYXAMBI?**

#### **Do not take GLYXAMBI if you:**

- have severe kidney problems or are on dialysis
- are allergic to linagliptin (TRADJENTA), empagliflozin (JARDIANCE) or any of the ingredients in GLYXAMBI. See the end of this Medication Guide for a complete list of ingredients in GLYXAMBI.

Symptoms of a serious allergic reaction to GLYXAMBI may include:

- skin rash, itching, flaking or peeling
- raised red patches on your skin (hives)
- swelling of your face, lips, tongue and throat that may cause difficulty in breathing or swallowing
- difficulty with swallowing or breathing

If you have any of these symptoms, stop taking GLYXAMBI and tell your doctor or go to the nearest hospital emergency room right away.

### **What should I tell my doctor before taking GLYXAMBI?**

#### **Before you take GLYXAMBI, tell your doctor if you:**

- have kidney problems
- have liver problems
- have or have had inflammation of your pancreas (pancreatitis).
- have a history of infection of the vagina or penis
- have a history of urinary tract infection or problems with urination
- have any other medical conditions.
- are pregnant or plan to become pregnant. It is not known if GLYXAMBI will harm your unborn baby. If you are pregnant, talk with your doctor about the best way to control your blood

sugar while you are pregnant. Tell your doctor right away if you become pregnant during treatment with GLYXAMBI.

- are breastfeeding or plan to breastfeed. It is not known if GLYXAMBI passes into your breast milk. Talk with your doctor about the best way to feed your baby if you take GLYXAMBI.

**Tell your doctor about all the medicines you take**, including prescription and over-the-counter medicines, vitamins, and herbal supplements.

GLYXAMBI may affect the way other medicines work, and other medicines may affect how GLYXAMBI works.

**Especially tell your doctor if you take:**

- insulin or other medicines that can lower your blood sugar
- diuretics (water pills)
- rifampin (Rifadin®, Rimactane®, Rifater®, Rifamate®)\*, an antibiotic that is used to treat tuberculosis

Know the medicines you take. Keep a list of them to show your doctor and pharmacist when you get a new medicine.

**How should I take GLYXAMBI?**

- Take GLYXAMBI exactly as your doctor tells you to take it.
- Take GLYXAMBI 1 time each day in the morning, with or without food.
- If you miss a dose, take it as soon as you remember. If you do not remember until it is time for your next dose, skip the missed dose and go back to your regular schedule. Do not take two doses of GLYXAMBI at the same time.
- Your doctor may tell you to take GLYXAMBI along with other diabetes medicines. Low blood sugar can happen more often when GLYXAMBI is taken with certain other diabetes medicines. See **“What are the possible side effects of GLYXAMBI?”**
- If you take too much GLYXAMBI, call your doctor or local poison control center or go to the nearest hospital emergency room right away.
- When your body is under some types of stress, such as fever, trauma (such as a car accident), infection, or surgery, the amount of diabetes medicine that you need may change. Tell your doctor right away if you have any of these conditions and follow your doctor’s instructions.
- Check your blood sugar as your doctor tells you to.
- Stay on your prescribed diet and exercise program while taking GLYXAMBI.
- Talk to your doctor about how to prevent, recognize and manage low blood sugar (hypoglycemia), high blood sugar (hyperglycemia), and complications of diabetes.
- Your doctor will check your diabetes with regular blood tests, including your blood sugar levels and your hemoglobin A1C.
- When taking GLYXAMBI, you may have sugar in your urine, which will show up on a urine test.

**What are the possible side effects of GLYXAMBI?**

**GLYXAMBI may cause serious side effects, including:**

- See **“What is the most important information I should know about GLYXAMBI?”**

- **Low blood sugar (hypoglycemia).** If you take GLYXAMBI with another medicine that can cause low blood sugar, such as a sulfonylurea or insulin, your risk of getting low blood sugar is higher. The dose of your sulfonylurea medicine or insulin may need to be lowered while you take GLYXAMBI. Signs and symptoms of low blood sugar may include:
  - headache
  - drowsiness
  - weakness
  - confusion
  - irritability
  - hunger
  - fast heart beat
  - sweating
  - feeling jittery
- **Urinary tract infections** are a common side effect of GLYXAMBI but can sometimes be serious. Signs and symptoms of a urinary tract infection may include a burning feeling when passing urine, urine that looks cloudy, pain in the pelvis, or back pain. Tell your doctor if you have any signs or symptoms of a urinary tract infection.
- **Allergic (hypersensitivity) reactions.** Serious allergic reactions can happen after your first dose or up to 3 months after starting GLYXAMBI. Symptoms may include:
  - swelling of your face, lips, throat, and other areas on your skin
  - difficulty with swallowing or breathing
  - raised, red areas on your skin (hives)
  - skin rash, itching, flaking, or peeling

If you have these symptoms, stop taking GLYXAMBI and tell your doctor or go to the nearest hospital emergency room right away.

- **Kidney problems**, especially in people 75 years of age and older and people who already have kidney problems
- **Increased fats in your blood (cholesterol)**

**The most common side effects of GLYXAMBI include:**

- stuffy or runny nose and sore throat
- upper respiratory tract infection

Tell your doctor if you have any side effect that bothers you or that does not go away.

These are not all the possible side effects of GLYXAMBI. For more information, ask your doctor or pharmacist.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

**How should I store GLYXAMBI?**

- Store GLYXAMBI at room temperature between 68°F to 77°F (20°C to 25°C).

**Keep GLYXAMBI and all medicines out of the reach of children.**

## General information about the safe and effective use of GLYXAMBI.

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

This Medication Guide summarizes the most important information about GLYXAMBI. If you would like more information, talk with your doctor. You can ask your pharmacist or doctor for information about GLYXAMBI that is written for health professionals.

For more information, go to [www.glyxambi.com](http://www.glyxambi.com), or scan the code below, or call Boehringer Ingelheim Pharmaceuticals, Inc. at 1-800-542-6257 or (TTY) 1-800-459-9906.



## What are the ingredients in GLYXAMBI?

**Active ingredients:** empagliflozin and linagliptin

**Inactive ingredients:** mannitol, pregelatinized starch, corn starch, copovidone, crospovidone, talc and magnesium stearate. The film coating contains the following inactive ingredients: hypromellose, mannitol, talc, titanium dioxide, polyethylene glycol.

10 mg/5 mg tablets also contain yellow ferric oxide.

25 mg/5 mg tablets also contain red ferric oxide.

This Medication Guide has been approved by the U.S. Food and Drug Administration.

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