

## HIGHLIGHTS OF PRESCRIBING INFORMATION

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

GLUCOPHAGE® (metformin hydrochloride) tablets, for oral use  
GLUCOPHAGE® XR (metformin hydrochloride) extended-release tablets, for oral use  
Initial U.S. Approval: 1995

### WARNING: LACTIC ACIDOSIS

See full prescribing information for complete boxed warning.

- Postmarketing cases of metformin-associated lactic acidosis have resulted in death, hypothermia, hypotension, and resistant bradyarrhythmias. Symptoms included malaise, myalgias, respiratory distress, somnolence, and abdominal pain. Laboratory abnormalities included elevated blood lactate levels, anion gap acidosis, increased lactate/pyruvate ratio; and metformin plasma levels generally >5 mcg/mL. (5.1)
- Risk factors include renal impairment, concomitant use of certain drugs, age >65 years old, radiological studies with contrast, surgery and other procedures, hypoxic states, excessive alcohol intake, and hepatic impairment. Steps to reduce the risk of and manage metformin-associated lactic acidosis in these high risk groups are provided in the Full Prescribing Information. (5.1)
- If lactic acidosis is suspected, discontinue GLUCOPHAGE/GLUCOPHAGE XR and institute general supportive measures in a hospital setting. Prompt hemodialysis is recommended. (5.1)

### INDICATIONS AND USAGE

GLUCOPHAGE is a biguanide indicated as an adjunct to diet and exercise to improve glycemic control in adults and pediatric patients 10 years of age and older with type 2 diabetes mellitus. (1)

GLUCOPHAGE XR is a biguanide indicated as an adjunct to diet and exercise to improve glycemic control in adults with type 2 diabetes mellitus. (1)

### DOSAGE AND ADMINISTRATION

#### Adult Dosage for GLUCOPHAGE:

- Starting dose: 500 mg orally twice a day or 850 mg once a day, with meals (2.1)
- Increase the dose in increments of 500 mg weekly or 850 mg every 2 weeks, up to a maximum dose of 2550 mg per day, given in divided doses (2.1)
- Doses above 2000 mg may be better tolerated given 3 times a day with meals (2.1)

#### Adult Dosage for GLUCOPHAGE XR:

- Swallow GLUCOPHAGE XR tablets whole and never crush, cut or chew (2.1)
- Starting dose: 500 mg orally once daily with the evening meal (2.1)
- Increase the dose in increments of 500 mg weekly, up to a maximum of 2000 mg once daily with the evening meal (2.1)
- Patients receiving GLUCOPHAGE may be switched to GLUCOPHAGE XR once daily at the same total daily dose, up to 2000 mg once daily (2.1)

#### Pediatric Dosage for GLUCOPHAGE:

- Starting dose: 500 mg orally twice a day, with meals (2.2)
- Increase dosage in increments of 500 mg weekly up to a maximum of 2000 mg per day, given in divided doses twice daily (2.2)

#### Renal Impairment:

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### WARNING: LACTIC ACIDOSIS

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- Prior to initiation, assess renal function with estimated glomerular filtration rate (eGFR) (2.3)
  - Do not use in patients with eGFR below 30 mL/minute/1.73 m<sup>2</sup> (2.3)
  - Initiation is not recommended in patients with eGFR between 30-45 mL/minute/1.73 m<sup>2</sup> (2.3)
  - Assess risk/benefit of continuing if eGFR falls below 45 mL/minute/1.73 m<sup>2</sup> (2.3)
  - Discontinue if eGFR falls below 30 mL/minute/1.73 m<sup>2</sup> (2.3)

#### Discontinuation for Iodinated Contrast Imaging Procedures:

- GLUCOPHAGE/GLUCOPHAGE XR may need to be discontinued at time of, or prior to, iodinated contrast imaging procedures (2.4)

#### DOSAGE FORMS AND STRENGTHS

- GLUCOPHAGE Tablets: 500 mg, 850 mg, and 1000 mg (3)
- GLUCOPHAGE XR Extended-Release Tablets: 500 mg and 750 mg (3)

#### CONTRAINDICATIONS

- Severe renal impairment (eGFR below 30 mL/min/1.73 m<sup>2</sup>) (4, 5.1)
- Hypersensitivity to metformin (4)
- Acute or chronic metabolic acidosis, including diabetic ketoacidosis, with or without coma. (4)

#### WARNINGS AND PRECAUTIONS

- *Lactic Acidosis:* See boxed warning. ( 5.1)
- *Vitamin B<sub>12</sub> Deficiency:* Metformin may lower vitamin B<sub>12</sub> levels. Measure hematological parameters annually and vitamin B<sub>12</sub> at 2 to 3 year intervals and manage any abnormalities. (5.2)
- *Hypoglycemia with Concomitant Use with Insulin and Insulin Secretagogues:* Increased risk of hypoglycemia when used in combination with insulin and/or an insulin secretagogue. Lower dose of insulin or insulin secretagogue may be required (5.3)

#### ADVERSE REACTIONS

For GLUCOPHAGE/GLUCOPHAGE XR, the most common adverse reactions (>5.0%) are diarrhea, nausea/vomiting, flatulence, asthenia, indigestion, abdominal discomfort, and headache. (6.1)

To report SUSPECTED ADVERSE REACTIONS, contact Bristol-Myers Squibb at 1-800-721-5072 or FDA at 1-800-FDA-1088 or

[www.fda.gov/medwatch](http://www.fda.gov/medwatch)

#### DRUG INTERACTIONS

- Carbonic anhydrase inhibitors may increase risk of lactic acidosis. Consider more frequent monitoring (7)
- Drugs that reduce metformin clearance (such as ranolazine, vandetanib, dolutegravir, and cimetidine) may increase the accumulation of metformin. Consider the benefits and risks of concomitant use (7)
- Alcohol can potentiate the effect of metformin on lactate metabolism. Warn patients against excessive alcohol intake (7)

#### USE IN SPECIFIC POPULATIONS

- Females and Males of Reproductive Potential: Advise premenopausal females of the potential for an unintended pregnancy. (8.3)
- Geriatric Use: Assess renal function more frequently. (8.5)
- Hepatic Impairment: Avoid use in patients with hepatic impairment. (8.7)

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## FULL PRESCRIBING INFORMATION

### WARNING: LACTIC ACIDOSIS

Postmarketing cases of metformin-associated lactic acidosis have resulted in death, hypothermia, hypotension, and resistant bradyarrhythmias. The onset of metformin-associated lactic acidosis is often subtle, accompanied only by nonspecific symptoms such as malaise, myalgias, respiratory distress, somnolence, and abdominal pain. Metformin-associated lactic acidosis was characterized by elevated blood lactate levels (>5 mmol/Liter), anion gap acidosis (without evidence of ketonuria or ketonemia), an increased lactate/pyruvate ratio; and metformin plasma levels generally >5 mcg/mL [see *Warnings and Precautions (5.1)*].

Risk factors for metformin-associated lactic acidosis include renal impairment, concomitant use of certain drugs (e.g. carbonic anhydrase inhibitors such as topiramate), age 65 years old or greater, having a radiological study with contrast, surgery and other procedures, hypoxic states (e.g., acute congestive heart failure), excessive alcohol intake, and hepatic impairment.

Steps to reduce the risk of and manage metformin-associated lactic acidosis in these high risk groups are provided [see *Dosage and Administration (2.3), (2.7), Contraindications (4), Warnings and Precautions (5.1)*].

If metformin-associated lactic acidosis is suspected, immediately discontinue GLUCOPHAGE or GLUCOPHAGE XR and institute general supportive measures in a hospital setting. Prompt hemodialysis is recommended [see *Warnings and Precautions (5.1)*].

## 1 INDICATIONS AND USAGE

GLUCOPHAGE is indicated as an adjunct to diet and exercise to improve glycemic control in adults and pediatric patients 10 years of age and older with type 2 diabetes mellitus.

GLUCOPHAGE XR is indicated as an adjunct to diet and exercise to improve glycemic control in adults with type 2 diabetes mellitus.

## 2 DOSAGE AND ADMINISTRATION

### 2.1 Adult Dosage

#### GLUCOPHAGE

- The recommended starting dose of GLUCOPHAGE is 500 mg orally twice a day or 850 mg once a day, given with meals.
- Increase the dose in increments of 500 mg weekly or 850 mg every 2 weeks on the basis of glycemic control and tolerability, up to a maximum dose of 2550 mg per day, given in divided doses.

- Doses above 2000 mg may be better tolerated given 3 times a day with meals.

### GLUCOPHAGE XR

- Swallow GLUCOPHAGE XR tablets whole and never crush, cut or chew.
- The recommended starting dose of GLUCOPHAGE XR is 500 mg orally once daily with the evening meal.
- Increase the dose in increments of 500 mg weekly on the basis of glycemic control and tolerability, up to a maximum of 2000 mg once daily with the evening meal.
- If glycemic control is not achieved with GLUCOPHAGE XR 2000 mg once daily, consider a trial of GLUCOPHAGE XR 1000 mg twice daily. If higher doses are required, switch to GLUCOPHAGE at total daily doses up to 2550 mg administered in divided daily doses, as described above.
- Patients receiving GLUCOPHAGE may be switched to GLUCOPHAGE XR once daily at the same total daily dose, up to 2000 mg once daily.

### **2.2 Pediatric Dosage for GLUCOPHAGE**

- The recommended starting dose of GLUCOPHAGE for pediatric patients 10 years of age and older is 500 mg orally twice a day, given with meals.
- Increase dosage in increments of 500 mg weekly on the basis of glycemic control and tolerability, up to a maximum of 2000 mg per day, given in divided doses twice daily.

### **2.3 Recommendations for Use in Renal Impairment**

- Assess renal function prior to initiation of GLUCOPHAGE/GLUCOPHAGE XR and periodically thereafter.
- GLUCOPHAGE/GLUCOPHAGE XR is contraindicated in patients with an estimated glomerular filtration rate (eGFR) below 30 mL/minute/1.73 m<sup>2</sup>.
- Initiation of GLUCOPHAGE/GLUCOPHAGE XR in patients with an eGFR between 30 – 45 mL/minute/1.73 m<sup>2</sup> is not recommended.
- In patients taking GLUCOPHAGE/GLUCOPHAGE XR whose eGFR later falls below 45 mL/min/1.73 m<sup>2</sup>, assess the benefit risk of continuing therapy.
- Discontinue GLUCOPHAGE/GLUCOPHAGE XR if the patient's eGFR later falls below 30 mL/minute/1.73 m<sup>2</sup> [see *Warnings and Precautions (5.1)*].

### **2.4 Discontinuation for Iodinated Contrast Imaging Procedures**

Discontinue GLUCOPHAGE/GLUCOPHAGE XR at the time of, or prior to, an iodinated contrast imaging procedure in patients with an eGFR between 30 and 60 mL/min/1.73 m<sup>2</sup>; in patients with

a history of liver disease, alcoholism, or heart failure; or in patients who will be administered intra-arterial iodinated contrast. Re-evaluate eGFR 48 hours after the imaging procedure; restart GLUCOPHAGE/GLUCOPHAGE XR if renal function is stable.

### **3 DOSAGE FORMS AND STRENGTHS**

GLUCOPHAGE is available as:

- *Tablets: 500 mg* round, white to off-white, film-coated debossed with "BMS 6060" around the periphery on one side and "500" debossed across the face of the other side.
- *Tablets: 850 mg* round, white to off-white, film-coated debossed with "BMS 6070" around the periphery on one side and "850" debossed across the face of the other side.
- *Tablets: 1000 mg* white, oval, biconvex, film-coated with "BMS 6071" debossed on one side and "1000" debossed on the opposite side and with a bisect line on both sides.

GLUCOPHAGE XR is available as:

- *Extended-release tablets: 500 mg* white to off-white, capsule shaped, biconvex, with "BMS 6063" debossed on one side and "500" debossed across the face of the other side.
- *Extended-release tablets: 750 mg* pale red and may have a mottled appearance, capsule shaped, biconvex, with "BMS 6064" debossed on one side and "750" debossed on the other side.

### **4 CONTRAINDICATIONS**

GLUCOPHAGE and GLUCOPHAGE XR are contraindicated in patients with:

- Severe renal impairment (eGFR below 30 mL/min/1.73 m<sup>2</sup>) [see *Warnings and Precautions (5.1)*].
- Hypersensitivity to metformin.
- Acute or chronic metabolic acidosis, including diabetic ketoacidosis, with or without coma.

### **5 WARNINGS AND PRECAUTIONS**

#### **5.1 Lactic Acidosis**

There have been postmarketing cases of metformin-associated lactic acidosis, including fatal cases. These cases had a subtle onset and were accompanied by nonspecific symptoms such as malaise, myalgias, abdominal pain, respiratory distress, or increased somnolence; however, hypotension and resistant bradyarrhythmias have occurred with severe acidosis. Metformin-associated lactic acidosis was characterized by elevated blood lactate concentrations (>5 mmol/L), anion gap acidosis (without evidence of ketonuria or ketonemia), and an increased lactate:pyruvate ratio; metformin plasma levels were generally >5 mcg/mL. Metformin decreases liver

uptake of lactate increasing lactate blood levels which may increase the risk of lactic acidosis, especially in patients at risk.

If metformin-associated lactic acidosis is suspected, general supportive measures should be instituted promptly in a hospital setting, along with immediate discontinuation of GLUCOPHAGE/GLUCOPHAGE XR. In GLUCOPHAGE/GLUCOPHAGE XR treated patients with a diagnosis or strong suspicion of lactic acidosis, prompt hemodialysis is recommended to correct the acidosis and remove accumulated metformin (metformin hydrochloride is dialyzable with a clearance of up to 170 mL/min under good hemodynamic conditions). Hemodialysis has often resulted in reversal of symptoms and recovery.

Educate patients and their families about the symptoms of lactic acidosis and, if these symptoms occur, instruct them to discontinue GLUCOPHAGE/GLUCOPHAGE XR and report these symptoms to their healthcare provider.

For each of the known and possible risk factors for metformin-associated lactic acidosis, recommendations to reduce the risk of and manage metformin-associated lactic acidosis are provided below:

- *Renal impairment*—The postmarketing metformin-associated lactic acidosis cases primarily occurred in patients with significant renal impairment.

The risk of metformin accumulation and metformin-associated lactic acidosis increases with the severity of renal impairment because metformin is substantially excreted by the kidney. Clinical recommendations based upon the patient's renal function include [see *Dosage and Administration (2.1)*, *Clinical Pharmacology (12.3)*]:

- Before initiating GLUCOPHAGE/GLUCOPHAGE XR, obtain an estimated glomerular filtration rate (eGFR).
  - GLUCOPHAGE/GLUCOPHAGE XR is contraindicated in patients with an eGFR less than 30 mL/min/1.73 m<sup>2</sup> [see *Contraindications (4)*].
  - Initiation of GLUCOPHAGE/GLUCOPHAGE XR is not recommended in patients with eGFR between 30-45 mL/min/1.73 m<sup>2</sup>.
  - Obtain an eGFR at least annually in all patients taking GLUCOPHAGE/GLUCOPHAGE XR. In patients at risk for the development of renal impairment (e.g., the elderly), renal function should be assessed more frequently.
  - In patients taking GLUCOPHAGE/GLUCOPHAGE XR whose eGFR falls below 45 mL/min/1.73 m<sup>2</sup>, assess the benefit and risk of continuing therapy.
- *Drug interactions* — The concomitant use of GLUCOPHAGE/GLUCOPHAGE XR with specific drugs may increase the risk of metformin-associated lactic acidosis: those that impair renal function, result in significant hemodynamic change, interfere with acid-base balance, or increase metformin accumulation. Consider more frequent monitoring of patients.
  - *Age 65 or greater* — The risk of metformin-associated lactic acidosis increases with the patient's age because elderly patients have a greater likelihood of having hepatic, renal, or

cardiac impairment than younger patients. Assess renal function more frequently in elderly patients.

- *Radiologic studies with contrast* — Administration of intravascular iodinated contrast agents in metformin-treated patients has led to an acute decrease in renal function and the occurrence of lactic acidosis. Stop GLUCOPHAGE/GLUCOPHAGE XR at the time of, or prior to, an iodinated contrast imaging procedure in patients with an eGFR between 30 and 60 mL/min/1.73 m<sup>2</sup>; in patients with a history of hepatic impairment, alcoholism or heart failure; or in patients who will be administered intra-arterial iodinated contrast. Re-evaluate eGFR 48 hours after the imaging procedure, and restart GLUCOPHAGE/GLUCOPHAGE XR if renal function is stable.
- *Surgery and other procedures* — Withholding of food and fluids during surgical or other procedures may increase the risk for volume depletion, hypotension, and renal impairment. GLUCOPHAGE/GLUCOPHAGE XR should be temporarily discontinued while patients have restricted food and fluid intake.
- *Hypoxic states* — Several of the postmarketing cases of metformin-associated lactic acidosis occurred in the setting of acute congestive heart failure (particularly when accompanied by hypoperfusion and hypoxemia). Cardiovascular collapse (shock), acute myocardial infarction, sepsis, and other conditions associated with hypoxemia have been associated with lactic acidosis and may cause prerenal azotemia. When such an event occurs, discontinue GLUCOPHAGE/GLUCOPHAGE XR.
- *Excessive alcohol intake* — Alcohol potentiates the effect of metformin on lactate metabolism. Patients should be warned against excessive alcohol intake while receiving GLUCOPHAGE/GLUCOPHAGE XR.
- *Hepatic impairment* — Patients with hepatic impairment have developed cases of metformin-associated lactic acidosis. This may be due to impaired lactate clearance resulting in higher lactate blood levels. Therefore, avoid use of GLUCOPHAGE/GLUCOPHAGE XR in patients with clinical or laboratory evidence of hepatic disease.

## 5.2 Vitamin B<sub>12</sub> Deficiency

In GLUCOPHAGE clinical trials of 29-week duration, a decrease to subnormal levels of previously normal serum vitamin B<sub>12</sub> levels was observed in approximately 7% of patients. Such decrease, possibly due to interference with B<sub>12</sub> absorption from the B<sub>12</sub>-intrinsic factor complex, may be associated with anemia but appears to be rapidly reversible with discontinuation of GLUCOPHAGE or vitamin B<sub>12</sub> supplementation. Certain individuals (those with inadequate vitamin B<sub>12</sub> or calcium intake or absorption) appear to be predisposed to developing subnormal vitamin B<sub>12</sub> levels. Measure hematologic parameters on an annual basis and vitamin B<sub>12</sub> at 2 to 3 year intervals in patients on GLUCOPHAGE/GLUCOPHAGE XR and manage any abnormalities [see *Adverse Reactions* (6.1)].

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

Insulin and insulin secretagogues (e.g., sulfonylurea) are known to cause hypoglycemia. GLUCOPHAGE/GLUCOPHAGE XR may increase the risk of hypoglycemia when combined

with insulin and/or an insulin secretagogue. Therefore, a lower dose of insulin or insulin secretagogue may be required to minimize the risk of hypoglycemia when used in combination with GLUCOPHAGE/GLUCOPHAGE XR [see *Drug Interactions (7)*].

#### 5.4 Macrovascular Outcomes

There have been no clinical studies establishing conclusive evidence of macrovascular risk reduction with GLUCOPHAGE/GLUCOPHAGE XR.

### 6 ADVERSE REACTIONS

The following adverse reactions are also discussed elsewhere in the labeling:

- Lactic Acidosis [see *Boxed Warning and Warnings and Precautions (5.1)*]
- Vitamin B12 Deficiency [see *Warnings and Precautions (5.2)*]
- Hypoglycemia [see *Warnings and Precautions (5.3)*]

#### 6.1 Clinical Studies 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.

#### GLUCOPHAGE

In a U.S. clinical trial of GLUCOPHAGE in patients with type 2 diabetes mellitus, a total of 141 patients received GLUCOPHAGE up to 2550 mg per day. Adverse reactions reported in greater than 5% of GLUCOPHAGE treated patients and that were more common than in placebo-treated patients, are listed in Table 1.

**Table 1: Adverse Reactions from a Clinical Trial of GLUCOPHAGE Occurring >5% and More Common than Placebo in Patients with Type 2 Diabetes Mellitus**

	GLUCOPHAGE (n=141)	Placebo (n=145)
Diarrhea	53%	12%
Nausea/Vomiting	26%	8%
Flatulence	12%	6%
Asthenia	9%	6%
Indigestion	7%	4%
Abdominal Discomfort	6%	5%
Headache	6%	5%



Diarrhea led to discontinuation of GLUCOPHAGE in 6% of patients. Additionally, the following adverse reactions were reported in  $\geq 1\%$  to  $\leq 5\%$  of GLUCOPHAGE treated patients and were more commonly reported with GLUCOPHAGE than placebo: abnormal stools, hypoglycemia, myalgia, lightheaded, dyspnea, nail disorder, rash, sweating increased, taste disorder, chest discomfort, chills, flu syndrome, flushing, palpitation.

In GLUCOPHAGE clinical trials of 29-week duration, a decrease to subnormal levels of previously normal serum vitamin B<sub>12</sub> levels was observed in approximately 7% of patients.

### *Pediatric Patients*

In clinical trials with GLUCOPHAGE in pediatric patients with type 2 diabetes mellitus, the profile of adverse reactions was similar to that observed in adults.

### GLUCOPHAGE XR

In placebo-controlled trials, 781 patients were administered GLUCOPHAGE XR. Adverse reactions reported in greater than 5% of the GLUCOPHAGE XR patients, and that were more common in GLUCOPHAGE XR- than placebo-treated patients, are listed in Table 2.

**Table 2: Adverse Reactions from Clinical Trials of GLUCOPHAGE XR Occurring  $>5\%$  and More Common than Placebo in Patients with Type 2 Diabetes Mellitus**

	<b>GLUCOPHAGE XR (n=781)</b>	<b>Placebo (n=195)</b>
Diarrhea	10%	3%
Nausea/Vomiting	7%	2%

Diarrhea led to discontinuation of GLUCOPHAGE XR in 0.6% of patients. Additionally, the following adverse reactions were reported in  $\geq 1.0\%$  to  $\leq 5.0\%$  of GLUCOPHAGE XR patients and were more commonly reported with GLUCOPHAGE XR than placebo: abdominal pain, constipation, distention abdomen, dyspepsia/heartburn, flatulence, dizziness, headache, upper respiratory infection, taste disturbance.

## **6.2 Postmarketing Experience**

The following adverse reactions have been identified during post approval use of metformin. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

Cholestatic, hepatocellular, and mixed hepatocellular liver injury have been reported with postmarketing use of metformin.

## 7 DRUG INTERACTIONS

Table 3 presents clinically significant drug interactions with GLUCOPHAGE/GLUCOPHAGE XR.

**Table 3: Clinically Significant Drug Interactions with GLUCOPHAGE/GLUCOPHAGE XR**

<b>Carbonic Anhydrase Inhibitors</b>	
<i>Clinical Impact:</i>	Carbonic anhydrase inhibitors frequently cause a decrease in serum bicarbonate and induce non-anion gap, hyperchloremic metabolic acidosis. Concomitant use of these drugs with GLUCOPHAGE/GLUCOPHAGE XR may increase the risk for lactic acidosis.
<i>Intervention:</i>	Consider more frequent monitoring of these patients.
<i>Examples:</i>	Topiramate, zonisamide, acetazolamide or dichlorophenamide.
<b>Drugs that Reduce GLUCOPHAGE/GLUCOPHAGE XR Clearance</b>	
<i>Clinical Impact:</i>	Concomitant use of drugs that interfere with common renal tubular transport systems involved in the renal elimination of metformin (e.g., organic cationic transporter-2 [OCT2] / multidrug and toxin extrusion [MATE] inhibitors) could increase systemic exposure to metformin and may increase the risk for lactic acidosis [see <i>Clinical Pharmacology (12.3)</i> ].
<i>Intervention:</i>	Consider the benefits and risks of concomitant use with GLUCOPHAGE/GLUCOPHAGE XR.
<i>Examples:</i>	Ranolazine, vandetanib, dolutegravir, and cimetidine.
<b>Alcohol</b>	
<i>Clinical Impact:</i>	Alcohol is known to potentiate the effect of metformin on lactate metabolism.
<i>Intervention:</i>	Warn patients against excessive alcohol intake while receiving GLUCOPHAGE/GLUCOPHAGE XR.
<b>Insulin Secretagogues or Insulin</b>	
<i>Clinical Impact:</i>	Coadministration of GLUCOPHAGE/GLUCOPHAGE XR with an insulin secretagogue (e.g., sulfonylurea) or insulin may increase the risk of hypoglycemia.
<i>Intervention:</i>	Patients receiving an insulin secretagogue or insulin may require lower doses of the insulin secretagogue or insulin.
<b>Drugs Affecting Glycemic Control</b>	
<i>Clinical Impact:</i>	Certain drugs tend to produce hyperglycemia and may lead to loss of glycemic control.
<i>Intervention:</i>	When such drugs are administered to a patient receiving GLUCOPHAGE/GLUCOPHAGE XR, observe the patient closely for loss of blood glucose control. When such drugs are withdrawn from a patient receiving GLUCOPHAGE/GLUCOPHAGE XR, observe the patient closely for hypoglycemia.
<i>Examples:</i>	Thiazides and other diuretics, corticosteroids, phenothiazines, thyroid products, estrogens, oral contraceptives, phenytoin, nicotinic acid, sympathomimetics, calcium channel blockers, and isoniazid.

## 8 USE IN SPECIFIC POPULATIONS

### 8.1 Pregnancy

#### Risk Summary

Limited data with GLUCOPHAGE/GLUCOPHAGE XR in pregnant women are not sufficient to determine a drug-associated risk for major birth defects or miscarriage. Published studies with metformin use during pregnancy have not reported a clear association with metformin and major birth defect or miscarriage risk [see Data]. There are risks to the mother and fetus associated with poorly controlled diabetes mellitus in pregnancy [see Clinical Considerations].

No adverse developmental effects were observed when metformin was administered to pregnant Sprague Dawley rats and rabbits during the period of organogenesis at doses up to 2- and 5-times, respectively, a 2550 mg clinical dose, based on body surface area [see Data].

The estimated background risk of major birth defects is 6–10% in women with pre-gestational diabetes mellitus with an HbA1C >7 and has been reported to be as high as 20–25% in women with a HbA1C >10. The estimated background risk of miscarriage for the indicated population is unknown. In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2–4% and 15–20%, respectively.

#### Clinical Considerations

##### *Disease-associated maternal and/or embryo/fetal risk*

Poorly-controlled diabetes mellitus in pregnancy increases the maternal risk for diabetic ketoacidosis, pre-eclampsia, spontaneous abortions, preterm delivery, stillbirth and delivery complications. Poorly controlled diabetes mellitus increases the fetal risk for major birth defects, stillbirth, and macrosomia related morbidity.

#### Data

##### *Human Data*

Published data from post-marketing studies have not reported a clear association with metformin and major birth defects, miscarriage, or adverse maternal or fetal outcomes when metformin was used during pregnancy. However, these studies cannot definitely establish the absence of any metformin-associated risk because of methodological limitations, including small sample size and inconsistent comparator groups.

##### *Animal Data*

Metformin hydrochloride did not adversely affect development outcomes when administered to pregnant rats and rabbits at doses up to 600 mg/kg/day. This represents an exposure of about 2 and 5 times a 2550 mg clinical dose based on body surface area comparisons for rats and rabbits, respectively. Determination of fetal concentrations demonstrated a partial placental barrier to metformin.

### 8.2 Lactation

#### Risk Summary

Limited published studies report that metformin is present in human milk [see Data]. However, there is insufficient information to determine the effects of metformin on the breastfed infant and no available information on the effects of metformin on milk production. Therefore, the developmental and health benefits of breastfeeding should be considered along with the mother's clinical need for GLUCOPHAGE/GLUCOPHAGE XR and any potential adverse effects on the breastfed child from GLUCOPHAGE/GLUCOPHAGE XR or from the underlying maternal condition.

#### Data

Published clinical lactation studies report that metformin is present in human milk which resulted in infant doses approximately 0.11% to 1% of the maternal weight-adjusted dosage and a milk/plasma ratio ranging between 0.13 and 1. However, the studies were not designed to definitely establish the risk of use of metformin during lactation because of small sample size and limited adverse event data collected in infants.

### **8.3 Females and Males of Reproductive Potential**

Discuss the potential for unintended pregnancy with premenopausal women as therapy with GLUCOPHAGE/GLUCOPHAGE XR may result in ovulation in some anovulatory women.

### **8.4 Pediatric Use**

#### GLUCOPHAGE

The safety and effectiveness of GLUCOPHAGE for the treatment of type 2 diabetes mellitus have been established in pediatric patients 10 to 16 years old. Safety and effectiveness of GLUCOPHAGE have not been established in pediatric patients less than 10 years old.

Use of GLUCOPHAGE in pediatric patients 10 to 16 years old for the treatment of type 2 diabetes mellitus is supported by evidence from adequate and well-controlled studies of GLUCOPHAGE in adults with additional data from a controlled clinical study in pediatric patients 10 to 16 years old with type 2 diabetes mellitus, which demonstrated a similar response in glycemic control to that seen in adults [see *Clinical Studies (14.1)*]. In this study, adverse reactions were similar to those described in adults. A maximum daily dose of 2000 mg of GLUCOPHAGE is recommended. [See *Dosage and Administration (2.2)*.]

#### GLUCOPHAGE XR

Safety and effectiveness of GLUCOPHAGE XR in pediatric patients have not been established.

### **8.5 Geriatric Use**

Controlled clinical studies of GLUCOPHAGE/GLUCOPHAGE XR did not include sufficient numbers of elderly patients to determine whether they respond differently from younger patients. In general, dose selection for an elderly patient should be cautious, usually starting at the low end of the dosing range, reflecting the greater frequency of decreased hepatic, renal, or cardiac function, and of concomitant disease or other drug therapy and the higher risk of lactic acidosis. Assess renal function more frequently in elderly patients [see *Warnings and Precautions (5.1)*].

## 8.6 Renal Impairment

Metformin is substantially excreted by the kidney, and the risk of metformin accumulation and lactic acidosis increases with the degree of renal impairment. GLUCOPHAGE/GLUCOPHAGE XR is contraindicated in severe renal impairment, patients with an estimated glomerular filtration rate (eGFR) below 30 mL/min/1.73 m<sup>2</sup> [see *Dosage and Administration* (2.3), *Contraindications* (4), *Warnings and Precautions* (5.1), and *Clinical Pharmacology* (12.3)].

## 8.7 Hepatic Impairment

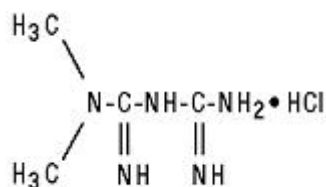
Use of metformin in patients with hepatic impairment has been associated with some cases of lactic acidosis. GLUCOPHAGE/GLUCOPHAGE XR is not recommended in patients with hepatic impairment. [see *Warnings and Precautions* (5.1)].

## 10 OVERDOSAGE

Overdose of metformin hydrochloride has occurred, including ingestion of amounts greater than 50 grams. Hypoglycemia was reported in approximately 10% of cases, but no causal association with metformin has been established. Lactic acidosis has been reported in approximately 32% of metformin overdose cases [see *Warnings and Precautions* (5.1)]. Metformin is dialyzable with a clearance of up to 170 mL/min under good hemodynamic conditions. Therefore, hemodialysis may be useful for removal of accumulated drug from patients in whom metformin overdose is suspected.

## 11 DESCRIPTION

GLUCOPHAGE/GLUCOPHAGE XR contain the antihyperglycemic agent metformin, which is a biguanide, in the form of monohydrochloride. The chemical name of metformin hydrochloride is *N,N*-dimethylimidodicarbonimidic diamide hydrochloride. The structural formula is as shown below:



Metformin hydrochloride is a white to off-white crystalline compound with a molecular formula of C<sub>4</sub>H<sub>11</sub>N<sub>5</sub> • HCl and a molecular weight of 165.63. It is freely soluble in water and is practically insoluble in acetone, ether, and chloroform. The pK<sub>a</sub> of metformin is 12.4. The pH of a 1% aqueous solution of metformin hydrochloride is 6.68.

GLUCOPHAGE tablets contain 500 mg, 850 mg, or 1000 mg of metformin hydrochloride, which is equivalent to 389.93 mg, 662.88 mg, 779.86 mg metformin base, respectively. Each tablet contains the inactive ingredients povidone and magnesium stearate. In addition, the coating for the

500 mg and 850 mg tablets contains hypromellose and the coating for the 1000 mg tablet contains hypromellose and polyethylene glycol.

GLUCOPHAGE XR contains 500 mg or 750 mg of metformin hydrochloride, which is equivalent to 389.93 mg, 584.90 mg metformin base, respectively.

GLUCOPHAGE XR 500 mg tablets contain the inactive ingredients hypromellose, microcrystalline cellulose, sodium carboxymethyl cellulose, and magnesium stearate.

GLUCOPHAGE XR 750 mg tablets contain the inactive ingredients hypromellose, sodium carboxymethyl cellulose, magnesium stearate and iron oxide pigment red.

## **12 CLINICAL PHARMACOLOGY**

### **12.1 Mechanism of Action**

Metformin is an antihyperglycemic agent which improves glucose tolerance in patients with type 2 diabetes mellitus, lowering both basal and postprandial plasma glucose. Metformin decreases hepatic glucose production, decreases intestinal absorption of glucose, and improves insulin sensitivity by increasing peripheral glucose uptake and utilization. With metformin therapy, insulin secretion remains unchanged while fasting insulin levels and day-long plasma insulin response may decrease.

### **12.3 Pharmacokinetics**

#### ***Absorption***

The absolute bioavailability of a GLUCOPHAGE 500 mg tablet given under fasting conditions is approximately 50% to 60%. Studies using single oral doses of GLUCOPHAGE 500 to 1500 mg and 850 to 2550 mg, indicate that there is a lack of dose proportionality with increasing doses, which is due to decreased absorption rather than an alteration in elimination. At usual clinical doses and dosing schedules of GLUCOPHAGE, steady state plasma concentrations of metformin are reached within 24 to 48 hours and are generally  $<1 \mu\text{g/mL}$ .

Following a single oral dose of GLUCOPHAGE XR,  $C_{\text{max}}$  is achieved with a median value of 7 hours and a range of 4 to 8 hours. Peak plasma levels are approximately 20% lower compared to the same dose of GLUCOPHAGE, however, the extent of absorption (as measured by AUC) is comparable to GLUCOPHAGE.

At steady state, the AUC and  $C_{\text{max}}$  are less than dose proportional for GLUCOPHAGE XR within the range of 500 to 2000 mg administered once daily. Peak plasma levels are approximately 0.6, 1.1, 1.4 and 1.8 mcg/mL for 500, 1000, 1500, and 2000 mg once-daily doses, respectively. The extent of metformin absorption (as measured by AUC) from GLUCOPHAGE XR at a 2000 mg once-daily dose is similar to the same total daily dose administered as GLUCOPHAGE tablets 1000 mg twice daily. After repeated administration of GLUCOPHAGE XR, metformin did not accumulate in plasma.

*Effect of food:* Food decreases the extent of absorption and slightly delays the absorption of metformin, as shown by approximately a 40% lower mean peak plasma concentration ( $C_{\max}$ ), a 25% lower area under the plasma concentration versus time curve (AUC), and a 35-minute prolongation of time to peak plasma concentration ( $T_{\max}$ ) following administration of a single 850 mg tablet of GLUCOPHAGE with food, compared to the same tablet strength administered fasting. Although the extent of metformin absorption (as measured by AUC) from the GLUCOPHAGE XR tablet increased by approximately 50% when given with food, there was no effect of food on  $C_{\max}$  and  $T_{\max}$  of metformin. Both high and low fat meals had the same effect on the pharmacokinetics of GLUCOPHAGE XR.

### ***Distribution***

The apparent volume of distribution (V/F) of metformin following single oral doses of GLUCOPHAGE 850 mg averaged  $654 \pm 358$  L. Metformin is negligibly bound to plasma proteins. Metformin partitions into erythrocytes, most likely as a function of time.

### ***Metabolism***

Intravenous single-dose studies in normal subjects demonstrate that metformin is excreted unchanged in the urine and does not undergo hepatic metabolism (no metabolites have been identified in humans) nor biliary excretion.

### ***Elimination***

Renal clearance (see Table 4) is approximately 3.5 times greater than creatinine clearance, which indicates that tubular secretion is the major route of metformin elimination. Following oral administration, approximately 90% of the absorbed drug is eliminated via the renal route within the first 24 hours, with a plasma elimination half-life of approximately 6.2 hours. In blood, the elimination half-life is approximately 17.6 hours, suggesting that the erythrocyte mass may be a compartment of distribution.

## **Specific Populations**

### ***Renal Impairment***

In patients with decreased renal function the plasma and blood half-life of metformin is prolonged and the renal clearance is decreased (see Table 3) [See *Dosage and Administration* (2.3), *Contraindications* (4), *Warnings and Precautions* (5.1) and *Use in Specific Populations* (8.6)].

### ***Hepatic Impairment***

No pharmacokinetic studies of metformin have been conducted in patients with hepatic impairment [See *Warnings and Precautions* (5.1) and *Use in Specific Populations* (8.7)].

## Geriatrics

Limited data from controlled pharmacokinetic studies of GLUCOPHAGE in healthy elderly subjects suggest that total plasma clearance of metformin is decreased, the half-life is prolonged, and  $C_{max}$  is increased, compared to healthy young subjects. It appears that the change in metformin pharmacokinetics with aging is primarily accounted for by a change in renal function (see Table 4). [See *Warnings and Precautions (5.1)* and *Use in Specific Populations (8.5)*].

**Table 4: Select Mean ( $\pm$ S.D.) Metformin Pharmacokinetic Parameters Following Single or Multiple Oral Doses of GLUCOPHAGE**

Subject Groups: GLUCOPHAGE dose <sup>a</sup> (number of subjects)	$C_{max}$ <sup>b</sup> (mcg/mL)	$T_{max}$ <sup>c</sup> (hrs)	Renal Clearance (mL/min)
<b>Healthy, nondiabetic adults:</b>			
500 mg single dose (24)	1.03 ( $\pm$ 0.33)	2.75 ( $\pm$ 0.81)	600 ( $\pm$ 132)
850 mg single dose (74) <sup>d</sup>	1.60 ( $\pm$ 0.38)	2.64 ( $\pm$ 0.82)	552 ( $\pm$ 139)
850 mg three times daily for 19 doses <sup>e</sup> (9)	2.01 ( $\pm$ 0.42)	1.79 ( $\pm$ 0.94)	642 ( $\pm$ 173)
<b>Adults with type 2 diabetes mellitus:</b>			
850 mg single dose (23)	1.48 ( $\pm$ 0.5)	3.32 ( $\pm$ 1.08)	491 ( $\pm$ 138)
850 mg three times daily for 19 doses <sup>e</sup> (9)	1.90 ( $\pm$ 0.62)	2.01 ( $\pm$ 1.22)	550 ( $\pm$ 160)
<b>Elderly<sup>f</sup>, healthy nondiabetic adults:</b>			
850 mg single dose (12)	2.45 ( $\pm$ 0.70)	2.71 ( $\pm$ 1.05)	412 ( $\pm$ 98)
<b>Renal-impaired adults:</b>			
<b>850 mg single dose</b>			
<b>Mild</b> ( $CL_{Cr}$ <sup>g</sup> 61-90 mL/min) (5)	1.86 ( $\pm$ 0.52)	3.20 ( $\pm$ 0.45)	384 ( $\pm$ 122)
<b>Moderate</b> ( $CL_{Cr}$ 31-60 mL/min) (4)	4.12 ( $\pm$ 1.83)	3.75 ( $\pm$ 0.50)	108 ( $\pm$ 57)
<b>Severe</b> ( $CL_{Cr}$ 10-30 mL/min) (6)	3.93 ( $\pm$ 0.92)	4.01 ( $\pm$ 1.10)	130 ( $\pm$ 90)

<sup>a</sup> All doses given fasting except the first 18 doses of the multiple dose studies

<sup>b</sup> Peak plasma concentration

<sup>c</sup> Time to peak plasma concentration

<sup>d</sup> Combined results (average means) of five studies: mean age 32 years (range 23-59 years)

<sup>e</sup> Kinetic study done following dose 19, given fasting

<sup>f</sup> Elderly subjects, mean age 71 years (range 65-81 years)

<sup>g</sup>  $CL_{Cr}$  = creatinine clearance normalized to body surface area of 1.73 m<sup>2</sup>

## Pediatrics

After administration of a single oral GLUCOPHAGE 500 mg tablet with food, geometric mean metformin  $C_{max}$  and AUC differed less than 5% between pediatric type 2 diabetic patients (12-16 years of age) and gender- and weight-matched healthy adults (20-45 years of age), all with normal renal function.



## Gender

Metformin pharmacokinetic parameters did not differ significantly between normal subjects and patients with type 2 diabetes mellitus when analyzed according to gender (males=19, females=16).

## Race

No studies of metformin pharmacokinetic parameters according to race have been performed.

## Drug Interactions

### In Vivo Assessment of Drug Interactions

**Table 5: Effect of Coadministered Drug on Plasma Metformin Systemic Exposure**

Coadministered Drug	Dose of Coadministered Drug*	Dose of Metformin*	Geometric Mean Ratio (ratio with/without coadministered drug) No Effect = 1.00		
				AUC <sup>†</sup>	C <sub>max</sub>
<b>No dosing adjustments required for the following:</b>					
Glyburide	5 mg	850 mg	metformin	0.91 <sup>‡</sup>	0.93 <sup>‡</sup>
Furosemide	40 mg	850 mg	metformin	1.09 <sup>‡</sup>	1.22 <sup>‡</sup>
Nifedipine	10 mg	850 mg	metformin	1.16	1.21
Propranolol	40 mg	850 mg	metformin	0.90	0.94
Ibuprofen	400 mg	850 mg	metformin	1.05 <sup>‡</sup>	1.07 <sup>‡</sup>
<b>Cationic drugs eliminated by renal tubular secretion may reduce metformin elimination [See Warnings and Precautions (5.9) and Drug Interactions (7.2).]</b>					
Cimetidine	400 mg	850 mg	metformin	1.40	1.61
<b>Carbonic anhydrase inhibitors may cause metabolic acidosis [See Warnings and Precautions (5.1) and Drug Interactions (7.1).]</b>					
Topiramate	100 mg <sup>§</sup>	500 mg <sup>§</sup>	metformin	1.25 <sup>§</sup>	1.17

\* All metformin and coadministered drugs were given as single doses

<sup>†</sup> AUC = AUC(INF)

<sup>‡</sup> Ratio of arithmetic means

<sup>§</sup> At steady state with topiramate 100 mg every 12 hours and metformin 500 mg every 12 hours; AUC = AUC<sub>0-12h</sub>

**Table 6: Effect of Metformin on Coadministered Drug Systemic Exposure**

Coadministered Drug	Dose of Coadministered Drug*	Dose of Metformin*	Geometric Mean Ratio (ratio with/without metformin) No Effect = 1.00		
				AUC <sup>†</sup>	C <sub>max</sub>
<b>No dosing adjustments required for the following:</b>					
Glyburide	5 mg	850 mg	glyburide	0.78 <sup>‡</sup>	0.63 <sup>‡</sup>
Furosemide	40 mg	850 mg	furosemide	0.87 <sup>‡</sup>	0.69 <sup>‡</sup>
Nifedipine	10 mg	850 mg	nifedipine	1.10 <sup>§</sup>	1.08
Propranolol	40 mg	850 mg	propranolol	1.01 <sup>§</sup>	1.02
Ibuprofen	400 mg	850 mg	ibuprofen	0.97 <sup>¶</sup>	1.01 <sup>¶</sup>
Cimetidine	400 mg	850 mg	cimetidine	0.95 <sup>§</sup>	1.01

\* All metformin and coadministered drugs were given as single doses

<sup>†</sup> AUC = AUC(INF) unless otherwise noted

<sup>‡</sup> Ratio of arithmetic means, p-value of difference <0.05

<sup>§</sup> AUC(0-24 hr) reported

<sup>¶</sup> Ratio of arithmetic means

## 13 NONCLINICAL TOXICOLOGY

### 13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

Long-term carcinogenicity studies have been performed in rats (dosing duration of 104 weeks) and mice (dosing duration of 91 weeks) at doses up to and including 900 mg/kg/day and 1500 mg/kg/day, respectively. These doses are both approximately 3 times the maximum recommended human daily dose of 2550 mg based on body surface area comparisons. No evidence of carcinogenicity with metformin was found in either male or female mice. Similarly, there was no tumorigenic potential observed with metformin in male rats. There was, however, an increased incidence of benign stromal uterine polyps in female rats treated with 900 mg/kg/day.

There was no evidence of a mutagenic potential of metformin in the following *in vitro* tests: Ames test (*S. typhimurium*), gene mutation test (mouse lymphoma cells), or chromosomal aberrations test (human lymphocytes). Results in the *in vivo* mouse micronucleus test were also negative.

Fertility of male or female rats was unaffected by metformin when administered at doses as high as 600 mg/kg/day, which is approximately 2 times the maximum recommended human daily dose of 2550 mg based on body surface area comparisons.

## 14 CLINICAL STUDIES

### 14.1 GLUCOPHAGE

#### Adult Clinical Studies

A double-blind, placebo-controlled, multicenter US clinical trial involving obese patients with type 2 diabetes mellitus whose hyperglycemia was not adequately controlled with dietary management alone (baseline fasting plasma glucose [FPG] of approximately 240 mg/dL) was conducted. Patients were treated with GLUCOPHAGE (up to 2550 mg/day) or placebo for 29 weeks. The results are presented in Table 7.

**Table 7: Mean Change in Fasting Plasma Glucose and HbA1c at Week 29 Comparing GLUCOPHAGE vs Placebo in Patients with Type 2 Diabetes Mellitus**

	<b>GLUCOPHAGE (n=141)</b>	<b>Placebo (n=145)</b>	<b>p-Value</b>
<b>FPG (mg/dL)</b>			
Baseline	241.5	237.7	NS*
Change at FINAL VISIT	-53.0	6.3	0.001
<b>Hemoglobin A1c (%)</b>			
Baseline	8.4	8.2	NS*
Change at FINAL VISIT	-1.4	0.4	0.001

\* Not statistically significant

Mean baseline body weight was 201 lbs and 206 lbs in the GLUCOPHAGE and placebo arms, respectively. Mean change in body weight from baseline to week 29 was -1.4 lbs and -2.4 lbs in the GLUCOPHAGE and placebo arms, respectively. A 29-week, double-blind, placebo-controlled study of GLUCOPHAGE and glyburide, alone and in combination, was conducted in obese patients with type 2 diabetes mellitus who had failed to achieve adequate glycemic control while on maximum doses of glyburide (baseline FPG of approximately 250 mg/dL). Patients randomized to the combination arm started therapy with GLUCOPHAGE 500 mg and glyburide 20 mg. At the end of each week of the first 4 weeks of the trial, these patients had their dosages of GLUCOPHAGE increased by 500 mg if they had failed to reach target fasting plasma glucose. After week 4, such dosage adjustments were made monthly, although no patient was allowed to exceed GLUCOPHAGE 2500 mg. Patients in the GLUCOPHAGE only arm (metformin plus placebo) discontinued glyburide and followed the same titration schedule. Patients in the glyburide arm continued the same dose of glyburide. At the end of the trial, approximately 70% of the patients in the combination group were taking GLUCOPHAGE 2000 mg/glyburide 20 mg or GLUCOPHAGE 2500 mg/glyburide 20 mg. The results are displayed in Table 8.

**Table 8: Mean Change in Fasting Plasma Glucose and HbA1c at Week 29 Comparing GLUCOPHAGE/Glyburide (Comb) vs Glyburide (Glyb) vs GLUCOPHAGE (GLU): in Patients with Type 2 Diabetes Mellitus with Inadequate Glycemic Control on Glyburide**

	Comb (n=213)	Glyb (n=209)	GLU (n=210)	p-Values		
				Glyb vs Comb	GLU vs Comb	GLU vs Glyb
<b>Fasting Plasma Glucose (mg/dL)</b>						
Baseline	250.5	247.5	253.9	NS*	NS*	NS*
Change at FINAL VISIT	-63.5	13.7	-0.9	0.001	0.001	0.025
<b>Hemoglobin A1c (%)</b>						
Baseline	8.8	8.5	8.9	NS*	NS*	0.007
Change at FINAL VISIT	-1.7	0.2	-0.4	0.001	0.001	0.001

\* Not statistically significant

Mean baseline body weight was 202 lbs, 203 lbs, and 204 lbs in the GLUCOPHAGE/glyburide, glyburide, and GLUCOPHAGE arms, respectively. Mean change in body weight from baseline to week 29 was 0.9 lbs, -0.7 lbs, and -8.4 lbs in the GLUCOPHAGE/glyburide, glyburide, and GLUCOPHAGE arms, respectively.

#### Pediatric Clinical Studies

A double-blind, placebo-controlled study in pediatric patients aged 10 to 16 years with type 2 diabetes mellitus (mean FPG 182.2 mg/dL), treatment with GLUCOPHAGE (up to 2000 mg/day) for up to 16 weeks (mean duration of treatment 11 weeks) was conducted. The results are displayed in Table 9.

**Table 9: Mean Change in Fasting Plasma Glucose at Week 16 Comparing GLUCOPHAGE vs Placebo in Pediatric Patients<sup>a</sup> with Type 2 Diabetes Mellitus**

	GLUCOPHAGE	Placebo	p-Value
<b>FPG (mg/dL)</b>	<b>(n=37)</b>	<b>(n=36)</b>	
Baseline	162.4	192.3	
Change at FINAL VISIT	-42.9	21.4	<0.001

<sup>a</sup> Pediatric patients mean age 13.8 years (range 10-16 years)

Mean baseline body weight was 205 lbs and 189 lbs in the GLUCOPHAGE and placebo arms, respectively. Mean change in body weight from baseline to week 16 was -3.3 lbs and -2.0 lbs in the GLUCOPHAGE and placebo arms, respectively.

## 14.2 GLUCOPHAGE XR

A 24-week, double-blind, placebo-controlled study of GLUCOPHAGE XR, taken once daily with the evening meal, was conducted in patients with type 2 diabetes mellitus who had failed to achieve glycemic control with diet and exercise. Patients entering the study had a mean baseline HbA<sub>1c</sub> of 8.0% and a mean baseline FPG of 176 mg/dL. The treatment dose was increased to 1500 mg once daily if at Week 12 HbA<sub>1c</sub> was  $\geq 7.0\%$  but  $< 8.0\%$  (patients with HbA<sub>1c</sub>  $\geq 8.0\%$  were discontinued from the study). At the final visit (24-week), mean HbA<sub>1c</sub> had increased 0.2% from baseline in placebo patients and decreased 0.6% with GLUCOPHAGE XR.

A 16-week, double-blind, placebo-controlled, dose-response study of GLUCOPHAGE XR, taken once daily with the evening meal or twice daily with meals, was conducted in patients with type 2 diabetes mellitus who had failed to achieve glycemic control with diet and exercise. The results are shown in Table 10.

**Table 10: Mean Changes from Baseline\* in HbA<sub>1c</sub> and Fasting Plasma Glucose at Week 16 Comparing GLUCOPHAGE XR vs Placebo in Patients with Type 2 Diabetes Mellitus**

	GLUCOPHAGE XR					Placebo
	500 mg Once Daily	1000 mg Once Daily	1500 mg Once Daily	2000 mg Once Daily	1000 mg Twice Daily	
<b>Hemoglobin A<sub>1c</sub> (%)</b>	<b>(n=115)</b>	<b>(n=115)</b>	<b>(n=111)</b>	<b>(n=125)</b>	<b>(n=112)</b>	<b>(n=111)</b>
Baseline	8.2	8.4	8.3	8.4	8.4	8.4
Change at FINAL VISIT	-0.4	-0.6	-0.9	-0.8	-1.1	0.1
p-value <sup>a</sup>	<0.001	<0.001	<0.001	<0.001	<0.001	-
<b>FPG (mg/dL)</b>	<b>(n=126)</b>	<b>(n=118)</b>	<b>(n=120)</b>	<b>(n=132)</b>	<b>(n=122)</b>	<b>(n=113)</b>
Baseline	182.7	183.7	178.9	181.0	181.6	179.6
Change at FINAL VISIT	-15.2	-19.3	-28.5	-29.9	-33.6	7.6
p-value <sup>a</sup>	<0.001	<0.001	<0.001	<0.001	<0.001	-

<sup>a</sup> All comparisons versus Placebo

Mean baseline body weight was 193 lbs, 192 lbs, 188 lbs, 196 lbs, 193 lbs and 194 lbs in the GLUCOPHAGE XR 500 mg, 1000 mg, 1500 mg, and 2000 mg once daily, 1000 mg twice daily and placebo arms, respectively. Mean change in body weight from baseline to week 16 was -1.3 lbs, -1.3 lbs, -0.7 lbs, -1.5 lbs, -2.2 lbs and -1.8 lbs, respectively.

A 24-week, double-blind, randomized study of GLUCOPHAGE XR, taken once daily with the evening meal, and GLUCOPHAGE, taken twice daily (with breakfast and evening meal), was conducted in patients with type 2 diabetes mellitus who had been treated with GLUCOPHAGE 500 mg twice daily for at least 8 weeks prior to study entry. The results are shown in Table 11.

**Table 11: Mean Changes from Baseline\* in HbA1c and Fasting Plasma Glucose at Week 24 Comparing GLUCOPHAGE XR vs GLUCOPHAGE in Patients with Type 2 Diabetes Mellitus**

	GLUCOPHAGE 500 mg Twice Daily	GLUCOPHAGE XR	
		1000 mg Once Daily	1500 mg Once Daily
<b>Hemoglobin A<sub>1c</sub> (%)</b>	<b>(n=67)</b>	<b>(n=72)</b>	<b>(n=66)</b>
Baseline	7.06	6.99	7.02
Change at FINAL VISIT (95% CI)	0.14 <sup>a</sup> (-0.04, 0.31)	0.27 (0.11, 0.43)	0.13 (-0.02, 0.28)
<b>FPG (mg/dL)</b>	<b>(n=69)</b>	<b>(n=72)</b>	<b>(n=70)</b>
Baseline	127.2	131.0	131.4
Change at FINAL VISIT (95% CI)	14.0 (7.0, 21.0)	11.5 (4.4, 18.6)	7.6 (1.0, 14.2)

<sup>†a</sup> n=68

Mean baseline body weight was 210lbs, 203 lbs and 193 lbs in the GLUCOPHAGE 500mg twice daily, and GLUCOPHAGE XR 1000mg and 1500mg once daily arms, respectively. Mean change in body weight from baseline to week 24 was 0.9 lbs, 1.1 lbs and 0.9 lbs, respectively.

## 16 HOW SUPPLIED/STORAGE AND HANDLING

### 16.1 How Supplied

**Table 13: GLUCOPHAGE/GLUCOPHAGE XR Available Strengths, Units, and Appearance**

GLUCOPHAGE Tablets			
500 mg	Bottles of 100	NDC 0087-6060-05	round, white to off-white, film-coated debossed with "BMS 6060" around the periphery on one side and "500" debossed across the face of the other side
	Bottles of 500	NDC 0087-6060-10	
850 mg	Bottles of 100	NDC 0087-6070-05	round, white to off-white, film-coated debossed with "BMS 6070" around the periphery on one side and "850" debossed across the face of the other side
1000 mg	Bottles of 100	NDC 0087-6071-11	white, oval, biconvex, film-coated with "BMS 6071" debossed on one side and "1000" debossed on the opposite side and with a bisect line on both sides
GLUCOPHAGE XR Extended-Release Tablets			

500 mg	Bottles of 100	NDC 0087-6063-13	white to off-white, capsule shaped, biconvex, with "BMS 6063" debossed on one side and "500" debossed across the face of the other side
750 mg	Bottles of 100	NDC 0087-6064-13	pale red and may have a mottled appearance, capsule shaped, biconvex, with "BMS 6064" debossed on one side and "750" debossed on the other side

## 16.2 Storage

Store at 20°–25°C (68°–77°F); excursions permitted to 15°–30°C (59°–86°F). [See USP Controlled Room Temperature.]

Dispense in light-resistant containers.

## 17 PATIENT COUNSELING INFORMATION

Advise the patient to read the FDA-approved patient labeling (Patient Information).

### *Lactic Acidosis:*

Explain the risks of lactic acidosis, its symptoms, and conditions that predispose to its development. Advise patients to discontinue GLUCOPHAGE/GLUCOPHAGE XR immediately and to promptly notify their healthcare provider if unexplained hyperventilation, myalgias, malaise, unusual somnolence or other nonspecific symptoms occur. Counsel patients against excessive alcohol intake and inform patients about importance of regular testing of renal function while receiving GLUCOPHAGE/GLUCOPHAGE XR. Instruct patients to inform their doctor that they are taking GLUCOPHAGE/GLUCOPHAGE XR prior to any surgical or radiological procedure, as temporary discontinuation may be required [see *Warnings and Precautions (5.1)*].

### *Hypoglycemia*

Inform patients that hypoglycemia may occur when GLUCOPHAGE/GLUCOPHAGE XR is coadministered with oral sulfonylureas and insulin. Explain to patients receiving concomitant therapy the risks of hypoglycemia, its symptoms and treatment, and conditions that predispose to its development [see *Warnings and Precautions (5.3)*].

### *Vitamin B12 Deficiency:*

Inform patients about importance of regular hematological parameters while receiving GLUCOPHAGE/GLUCOPHAGE XR [see *Warnings and Precautions (5.2)*].

### *Females of Reproductive Age:*

Inform females that treatment with GLUCOPHAGE/GLUCOPHAGE XR may result in ovulation in some premenopausal anovulatory women which may lead to unintended pregnancy [see *Use in Specific Populations (8.3)*].

### *GLUCOPHAGE XR Administration Information:*

Inform patients that GLUCOPHAGE XR must be swallowed whole and not crushed, cut, or chewed, and that the inactive ingredients may occasionally be eliminated in the feces as a soft mass that may resemble the original tablet.

Distributed by:  
Bristol-Myers Squibb Company  
Princeton, NJ 08543 USA

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Print code  
Rev TBD



**PATIENT INFORMATION**  
**GLUCOPHAGE® [gloo-kō-fahzh]**  
**(metformin hydrochloride) Tablets**  
**and**  
**GLUCOPHAGE® XR [gloo-kō-fahzh X-R]**  
**(metformin hydrochloride) Extended-Release Tablets**

Read the Patient Information that comes with GLUCOPHAGE and GLUCOPHAGE XR before you start taking it and each time you get a refill. There may be new information. This leaflet does not take the place of talking with your healthcare provider about your medical condition or treatment.

**What is the most important information I should know about GLUCOPHAGE and GLUCOPHAGE XR?**

**Serious side effects can happen in people taking GLUCOPHAGE or GLUCOPHAGE XR, including:**

**Lactic Acidosis.** Metformin hydrochloride, the medicine in GLUCOPHAGE and GLUCOPHAGE XR, can cause a rare, but serious, side effect called lactic acidosis (a build-up of lactic acid in the blood) that can cause death. Lactic acidosis is a medical emergency and must be treated in a hospital.

**Stop taking GLUCOPHAGE or GLUCOPHAGE XR and call your healthcare provider right away if you get any of the following symptoms of lactic acidosis:**

- feel very weak and tired
- have unusual (not normal) muscle pain
- have trouble breathing
- have unusual sleepiness or sleep longer than usual
- have unexplained stomach or intestinal problems with nausea and vomiting, or diarrhea
- feel cold, especially in your arms and legs
- feel dizzy or lightheaded
- have a slow or irregular heartbeat

**You have a higher chance of getting lactic acidosis if you:**

- have kidney problems. People whose kidneys are not working properly should not take GLUCOPHAGE OR GLUCOPHAGE XR.
- have liver problems.
- have congestive heart failure that requires treatment with medicines.
- drink a lot of alcohol (very often or short-term “binge” drinking).

- get dehydrated (lose a large amount of body fluids). This can happen if you are sick with a fever, vomiting, or diarrhea. Dehydration can also happen when you sweat a lot with activity or exercise and do not drink enough fluids.
- have certain x-ray tests with injectable dyes or contrast agents.
- have surgery.
- have a heart attack, severe infection, or stroke.
- are 80 years of age or older and have not had your kidney function tested.

### **What are GLUCOPHAGE and GLUCOPHAGE XR?**

- GLUCOPHAGE and GLUCOPHAGE XR are prescription medicines that contain metformin hydrochloride. GLUCOPHAGE and GLUCOPHAGE XR are used with diet and exercise to help control high blood sugar (hyperglycemia) in adults with type 2 diabetes.
- GLUCOPHAGE and GLUCOPHAGE XR are not for people with type 1 diabetes.
- GLUCOPHAGE and GLUCOPHAGE XR are not for people with diabetic ketoacidosis (increased ketones in your blood or urine).

GLUCOPHAGE and GLUCOPHAGE XR have the same active ingredient. However, GLUCOPHAGE XR works longer in your body. Both of these medicines help control your blood sugar in a number of ways. These include helping your body respond better to the insulin it makes naturally, decreasing the amount of sugar your liver makes, and decreasing the amount of sugar your intestines absorb. GLUCOPHAGE and GLUCOPHAGE XR do not cause your body to make more insulin.

### **Who should not take GLUCOPHAGE or GLUCOPHAGE XR?**

Some conditions increase your chance of getting lactic acidosis, or cause other problems if you take either of these medicines. Most of the conditions listed below can increase your chance of getting lactic acidosis.

### **Do not take GLUCOPHAGE or GLUCOPHAGE XR if you:**

- have kidney problems
- are allergic to the metformin hydrochloride in GLUCOPHAGE or GLUCOPHAGE XR or any of the ingredients in GLUCOPHAGE or GLUCOPHAGE XR. See the end of this leaflet for a complete list of ingredients in GLUCOPHAGE and GLUCOPHAGE XR.
- are going to get an injection of dye or contrast agents for an x-ray procedure or if you are going to have surgery and not able to eat or drink much. In these situations, GLUCOPHAGE or GLUCOPHAGE XR will need to be stopped for a short time. Talk to your healthcare provider about when you should stop GLUCOPHAGE or GLUCOPHAGE XR and when you should start GLUCOPHAGE or GLUCOPHAGE XR.

XR again. See **“What is the most important information I should know about GLUCOPHAGE or GLUCOPHAGE XR?”**

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### **What should I tell my healthcare provider before taking GLUCOPHAGE or GLUCOPHAGE XR?**

Before taking GLUCOPHAGE or GLUCOPHAGE XR, tell your healthcare provider if you:

- have type 1 diabetes. GLUCOPHAGE or GLUCOPHAGE XR should not be used to treat people with type 1 diabetes.
- have a history or risk for diabetic ketoacidosis (high levels of certain acids, known as ketones, in the blood or urine). GLUCOPHAGE or GLUCOPHAGE XR should not be used for the treatment of diabetic ketoacidosis.
- have kidney problems.
- have liver problems.
- have heart problems, including congestive heart failure.
- are older than 80 years. If you are over 80 years old you should not take GLUCOPHAGE or GLUCOPHAGE XR unless your kidneys have been checked and they are normal.
- drink alcohol very often, or drink a lot of alcohol in short-term “binge” drinking.
- are taking insulin.
- have any other medical conditions.
- are pregnant or plan to become pregnant. It is not known if GLUCOPHAGE or GLUCOPHAGE XR will harm your unborn baby. If you are pregnant, talk with your healthcare provider about the best way to control your blood sugar while you are pregnant.
- are breast-feeding or plan to breast-feed. It is not known if GLUCOPHAGE or GLUCOPHAGE XR passes into your breast milk. Talk with your healthcare provider about the best way to feed your baby while you take GLUCOPHAGE or GLUCOPHAGE XR.

**Tell your healthcare provider about all the medicines you take**, including prescription and nonprescription medicines, vitamins, and herbal supplements. Know the medicines you take. Keep a list of them to show your healthcare provider and pharmacist when you get a new medicine.

- GLUCOPHAGE or GLUCOPHAGE XR may affect the way other medicines work, and other medicines may affect how GLUCOPHAGE or GLUCOPHAGE XR works.

### **Can GLUCOPHAGE or GLUCOPHAGE XR be used in children?**

GLUCOPHAGE has been shown to effectively lower glucose levels in children (ages 10-16 years) with type 2 diabetes. GLUCOPHAGE has not been studied in children

younger than 10 years old. GLUCOPHAGE has not been studied in combination with other oral glucose-control medicines or insulin in children. If you have any questions about the use of GLUCOPHAGE in children, talk with your doctor or other healthcare provider.

GLUCOPHAGE XR has not been studied in children.

### **How should I take GLUCOPHAGE or GLUCOPHAGE XR?**

- Take GLUCOPHAGE or GLUCOPHAGE XR exactly as your healthcare provider tells you.
- GLUCOPHAGE or GLUCOPHAGE XR should be taken with meals to help lessen an upset stomach side effect.
- Swallow GLUCOPHAGE or GLUCOPHAGE XR whole. Do not crush, cut, or chew GLUCOPHAGE XR.
- You may sometimes pass a soft mass in your stools (bowel movement) that looks like GLUCOPHAGE or GLUCOPHAGE XR tablets. This is not harmful and will not affect the way GLUCOPHAGE XR works to control your diabetes.
- 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 healthcare provider right away if you have any of these problems.
- Your healthcare provider should do blood tests to check how well your kidneys are working before and during your treatment with GLUCOPHAGE or GLUCOPHAGE XR.
- Your healthcare provider will check your diabetes with regular blood tests, including your blood sugar levels and your hemoglobin A1C.
- Follow your healthcare provider's instructions for treating blood sugar that is too low (hypoglycemia). Talk to your healthcare provider if low blood sugar is a problem for you. See "**What are the possible side effects of GLUCOPHAGE or GLUCOPHAGE XR?**"
- Check your blood sugar as your healthcare provider tells you to.
- Stay on your prescribed diet and exercise program while taking GLUCOPHAGE or GLUCOPHAGE XR.
- If you miss a dose of GLUCOPHAGE or GLUCOPHAGE XR, take your next dose as prescribed unless your healthcare provider tells you differently. Do not take an extra dose the next day.
- If you take too much GLUCOPHAGE or GLUCOPHAGE XR, call your healthcare provider, local Poison Control Center, or go to the nearest hospital emergency room right away.

## **What should I avoid while taking GLUCOPHAGE or GLUCOPHAGE XR?**

Do not drink a lot of alcoholic drinks while taking GLUCOPHAGE or GLUCOPHAGE XR. This means you should not binge drink for short periods, and you should not drink a lot of alcohol on a regular basis. Alcohol can increase the chance of getting lactic acidosis.

## **What are the side effects of GLUCOPHAGE and GLUCOPHAGE XR?**

- **Lactic acidosis. Metformin, the active ingredient in GLUCOPHAGE and GLUCOPHAGE XR, can cause a rare but serious condition called lactic acidosis (a buildup of an acid in the blood) that can cause death. Lactic acidosis is a medical emergency and must be treated in the hospital.**

Call your doctor right away if you have any of the following symptoms, which could be signs of lactic acidosis:

- you feel cold in your hands or feet
- you feel dizzy or lightheaded
- you have a slow or irregular heartbeat
- you feel very weak or tired
- you have trouble breathing
- you feel sleepy or drowsy
- you have stomach pains, nausea or vomiting

Most people who have had lactic acidosis with metformin have other things that, combined with the metformin, led to the lactic acidosis. Tell your doctor if you have any of the following, because you have a higher chance for getting lactic acidosis with GLUCOPHAGE or GLUCOPHAGE XR if you:

- have severe kidney problems, or your kidneys are affected by certain x-ray tests that use injectable dye
- have liver problems
- drink alcohol very often, or drink a lot of alcohol in short-term "binge" drinking
- get dehydrated (lose a large amount of body fluids). This can happen if you are sick with a fever, vomiting, or diarrhea. Dehydration can also happen when you sweat a lot with activity or exercise and do not drink enough fluids
- have surgery
- have a heart attack, severe infection, or stroke

Common side effects of GLUCOPHAGE and GLUCOPHAGE XR include diarrhea, nausea, and upset stomach. These side effects generally go away after you take the medicine for a while. Taking your medicine with meals can help reduce these side effects. Tell your doctor if the side effects bother you a lot, last for more than a few weeks, come back after they've gone away, or start later in therapy. You may need a lower dose or need to stop taking the medicine for a short period or for good.

About 3 out of every 100 people who take GLUCOPHAGE or GLUCOPHAGE XR have an unpleasant metallic taste when they start taking the medicine. It lasts for a short time.

GLUCOPHAGE and GLUCOPHAGE XR rarely cause hypoglycemia (low blood sugar) by themselves. However, hypoglycemia can happen if you do not eat enough, if you drink alcohol, or if you take other medicines to lower blood sugar.

### **How should I store GLUCOPHAGE and GLUCOPHAGE XR?**

Store GLUCOPHAGE and GLUCOPHAGE XR at 68°F to 77°F (20°C to 25°C).

**Keep GLUCOPHAGE and GLUCOPHAGE XR and all medicines out of the reach of children.**

### **General information about the use of GLUCOPHAGE and GLUCOPHAGE XR**

If you have questions or problems, talk with your doctor or other healthcare provider. You can ask your doctor or pharmacist for the information about GLUCOPHAGE and GLUCOPHAGE XR that is written for healthcare professionals. Medicines are sometimes prescribed for purposes other than those listed in a patient information leaflet. Do not use GLUCOPHAGE or GLUCOPHAGE XR for a condition for which it was not prescribed. Do not share your medicine with other people.

### **What are the ingredients of GLUCOPHAGE and GLUCOPHAGE XR?**

Active ingredients of GLUCOPHAGE: metformin hydrochloride.

Inactive ingredients in each tablet of GLUCOPHAGE: povidone and magnesium stearate. In addition, the coating for the 500 mg and 850 mg tablets contain hypromellose and the coating for the 1000 mg tablet contains hypromellose and polyethylene glycol.

Active ingredients of GLUCOPHAGE XR: metformin hydrochloride.

Inactive ingredients in each tablet of GLUCOPHAGE XR 500 mg: sodium carboxymethyl cellulose, hypromellose, microcrystalline cellulose, and magnesium stearate.

Inactive ingredients in each tablet of GLUCOPHAGE XR 750 mg: sodium carboxymethyl cellulose, hypromellose, and magnesium stearate.

### **What is type 2 diabetes?**

Type 2 diabetes is a condition in which your body does not make enough insulin, and the insulin that your body produces does not work as well as it should. Your body can also make too much sugar. When this happens, sugar (glucose) builds up in the blood. This can lead to serious medical problems.

The main goal of treating diabetes is to lower your blood sugar to a normal level.

High blood sugar can be lowered by diet and exercise, and by certain medicines when necessary.

Talk to your healthcare provider about how to prevent, recognize, and take care of low blood sugar (hypoglycemia), high blood sugar (hyperglycemia), and problems you have because of your diabetes.

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