



# FDA Public Health Notification: Potentially Fatal Errors with GDH-PQQ\* Glucose Monitoring Technology

\* *glucose dehydrogenase pyrroloquinoline quinone*

August 13, 2009

This is to alert you to the possibility of falsely elevated blood glucose results when using GDH-PQQ glucose test strips on patients who are receiving therapeutic products containing certain non-glucose sugars. These sugars can falsely elevate glucose results, which may mask significant hypoglycemia or prompt excessive insulin administration, leading to serious injury or death. The following provides background information on this problem, a summary of fatality reports FDA has received, and recommendations to reduce the risk. This problem can occur wherever these products are used including in-patient and out-patient healthcare facilities, and at home.

## Nature of the problem

- GDH-PQQ glucose monitoring measures a patient's blood glucose value using methodology that cannot distinguish between glucose and other sugars. Certain non-glucose sugars, including maltose, xylose, and galactose, are found in certain drug and biologic formulations, or can result from the metabolism of a drug or therapeutic product.
- When these non-glucose sugars are present in the patient's blood, using a GDH-PQQ glucose test strip will produce an elevated glucose result which may suggest the need for clinical action. This can lead to inappropriate dosing and administration of insulin, potentially resulting in hypoglycemia, coma, or death.
- In addition, cases of actual hypoglycemia may go unrecognized if the patient and healthcare practitioner rely solely on the test result obtained with the GDH-PQQ glucose test strips.
- Other glucose test strip methodologies are not affected by the presence of non-glucose sugars. The unaffected methods are glucose oxidase, glucose dehydrogenase nicotinic adenine dinucleotide (GDH-NAD), or glucose dehydrogenase flavin adenine dinucleotide (GDH-FAD).
- Laboratory-based blood glucose assays do not use GDH-PQQ methodology and are not subject to falsely elevated results from non-glucose sugars.

## Recommendations

- Avoid using GDH-PQQ glucose test strips in healthcare facilities.  
[List of GDH-PQQ Glucose Test Strips](#)
- If your facility currently uses GDH-PQQ glucose test strips, NEVER use them on patients:
  - who are receiving interfering products\*\*, or
  - from whom or about whom you cannot obtain information regarding concomitant medication use, e.g., patients who are unresponsive or cannot adequately communicate.\*\*Interfering products containing non-glucose sugars include:
  - Extraneal (icodextrin) peritoneal dialysis solution
  - Some Immunoglobulins: Octagam 5%, Gamimune N 5%\*\*\*, WinRho SDF Liquid, Vaccinia Immune Globulin Intravenous(Human), and HepaGamB
  - Orencia (abatacept)
  - Adept adhesion reduction solution (4% icodextrin)
  - BEXXAR radioimmunotherapy agent

- Any product containing, or metabolized into maltose, galactose or xylose.  
Use ONLY laboratory-based glucose assays on these patients.
- Determine whether patients are receiving interfering products on admission and periodically during their stay at your facility.
- Educate staff and patients about the potential for falsely elevated glucose results in the presence of certain non-glucose sugars when using GDH-PQQ glucose test strips.
- Consider using drug interaction alerts in computer order entry systems, patient profiles and charts to alert staff to the potential for falsely elevated glucose results.
- Periodically verify glucose meter results with laboratory-based glucose assays if you are using GDH-PQQ test strips in patients who are not receiving interfering products.

\*\*\* Within the U.S., Gamimune N 5% has not been manufactured since December 2005, and no lots are in distribution in the U.S.

### List of GDH-PQQ Glucose Test Strips.

The following test strips (with associated meters) use GDH-PQQ methodology as of August 2009:

#### **Roche Diagnostics:**

1. ACCU-CHEK Comfort Curve test strips, for use with:
  - ACCU-CHEK Inform meters [model 2001201]
  - ACCU-CHEK Complete meters [models 200 and 250]
  - ACCU-CHEK Advantage meters [models 888, 831, 850, and 768]
  - ACCU-CHEK Voicemate meters [model 0009221]
2. ACCU-CHEK Aviva test strips, for use with:
  - ACCU-CHEK Aviva meters [models 525, 535, and 555]
3. ACCU-CHEK Compact test strips, for use with:
  - ACCU-CHEK Compact meters [model GF]
  - ACCU-CHEK Compact Plus meters [models GP and GT]
4. ACCU-CHEK Go test strips
  - ACCU-CHEK Go meters [model GJ]
5. ACCU-CHEK Active test strips
  - ACCU-CHEK Active meters [models GG and GN]

#### **Abbott Diabetes Care:**

1. Freestyle test strips, for use with:
  - FreeStyle meters
  - FreeStyle Flash meters
  - FreeStyle Freedom meters
2. Freestyle Lite test strips, for use with:
  - FreeStyle Lite meters
  - FreeStyle Freedom Lite meters

#### **Home Diagnostics:**

1. TRUEtest test strips
  - TRUEresult meters
  - TRUE2go meters

#### **Smiths Medical:**

1. Abbott Diabetes Care Freestyle test strips, for use with:
  - CoZmonitor blood glucose module (for use with the Deltec Cozmo Insulin Pump)

#### **Insulet:**

1. Abbott Diabetes Care Freestyle test strips, for use with:
  - OmniPod Insulin Management System

*Note: Test strips currently on the market may be distributed under multiple trade names. In addition, manufacturers of GDH-PQQ test strips currently on the market may subsequently change to non-GDH-PQQ methodology. Therefore, healthcare providers (and patients) should refer to device labeling or consult with test strip manufacturers to confirm the type of methodology used.*

## Reports received by FDA

From 1997-2009, FDA received 13 reports of death associated with GDH-PQQ glucose test strips in which there was documented interference from maltose or other non-glucose sugars. Six of the 13 deaths have occurred since 2008 despite FDA's efforts to communicate the risk. The deaths occurred in healthcare facilities. Ten of the 13 patients were receiving Extraneal (icodextrin) peritoneal dialysis solution for renal failure. Three of the 13 patients were receiving maltose-containing substances; one was receiving Potacor R, one was receiving Octagam (IVIG), and another was receiving an infusion that contained maltose. Patients were treated with insulin doses or insulin drips that were guided by falsely elevated results. Eight reports specified that test result values generated on GDH-PQQ test strips were 3 to 15 times higher than corresponding laboratory results. For example, in one patient the GDH-PQQ system generated a result of 200 mg/dL while the laboratory result was 19 mg/dL. In another case, a patient undergoing peritoneal dialysis with Extraneal was tested with a GDH-PQQ test strip which gave a result of 193 mg/dL, while the result obtained using a laboratory instrument was 8 mg/dL. Some reports indicated that serious patient injury, such as hypoglycemia, confusion, neurologic deterioration, severe hypoxia, brain damage, and coma occurred prior to death. FDA is working with manufacturers to address patient safety problems with GDH-PQQ glucose test strips and will continue to monitor adverse events associated with these products.

## Reporting adverse events

FDA requires hospitals and other user facilities to report deaths and serious injuries associated with the use of medical devices. If you suspect a reportable adverse event associated with a glucose meter or glucose test strip, you should follow the reporting procedure established by your facility. Prompt reporting of adverse events can improve FDA's understanding of and ability to communicate the risks associated with devices and assist in the identification of potential future problems associated with medical devices. If you suspect a falsely elevated blood glucose value associated with a non-glucose sugar interference, include information about the associated drug or biologic product in your adverse event report. We also encourage you to report any medical device adverse events related to glucose meters or glucose test strips that do not meet the requirements for mandatory reporting. You can report these directly to the device manufacturer or to MedWatch, the FDA's voluntary reporting program. This can be done online at <https://www.accessdata.fda.gov/scripts/medwatch/medwatch-online.htm>, by phone at 1-800-FDA-1088, by FAX at 1-800-FDA-0178; or by mailing FDA form 3500 (download from <http://www.fda.gov/Safety/MedWatch/HowToReport/DownloadForms>) to MedWatch, 5600 Fishers Lane, Rockville, MD 20857-9787.

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