



Use of Bar Coding Technology to Flag ER Patients on Metformin-Containing Drugs

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EXECUTIVE SUMMARY

- Sixty percent of Jennie Edmundson Hospital's inpatients are admitted through the emergency room.
- Type II diabetes accounts for 90–95% of all diagnosed cases of diabetes. There were about 1.6 million new cases of diabetes diagnosed in people 20 years or older in 2007. Consequently, we should expect to see an increase in Americans on metformin-containing drugs in the future.
- Jennie Edmundson Hospital's goal was to develop a hardwired process to identify patients on the medication metformin and who had a CT scan with contrast in the ER and were then admitted as an inpatient.

“Luck runs out, but safety is good for life.”
—Author unknown.

Jennie Edmundson Hospital is a 255 bed regional health center serving approximately 250,000 residents in southwest Iowa. Sixty percent of Jennie Edmundson's inpatients are admitted through the emergency room. When a type II diabetic ER patient had a CT scan with IV contrast and was admitted to the hospital, there was no hardwired process to identify those patients on metformin-containing medications or to order the proper blood tests to evaluate that their renal function was within normal limits prior to resuming metformin-containing medications. Our process that was used to track these patients involved a manual paper process, so these patients could be easily missed.

Type II diabetes accounts for 90–95% of all diagnosed cases of diabetes. There were about 1.6 million new cases of diabetes diagnosed in people 20 years or older in 2007. Diabetes is the leading cause of kidney failure, accounting for 44% of new cases in 2005.¹ Also cause for concern is

the fact that type II diabetes is associated with obesity and it is estimated by the Centers for Disease Control (CDC) that 64% of Americans are obese, with this trend rising.² We should expect to see an increase in Americans on metformin-containing drugs in the future.

Through the efforts of a multi-disciplinary team, Jennie Edmundson's goal was to develop a process to identify patients on metformin-containing medications utilizing hardware, our integrated pharmacy, radiology and registration system, and our bar coding software system in pharmacy. Our objective was to bar code ER patients' armbands, bar code the IV contrast, and develop a decision support rule within our software to alert the pharmacist to a type II diabetic patient who had been admitted as an inpatient and received a CT scan with contrast. This would prevent metformin administration until assessment of renal function had been determined.

The reason we felt this was an important safety issue is the fact that radiographic contrast may cause acute renal failure and has been associated with lactic acidosis in patients on metformin. Lactic

Radiographic contrast may cause acute renal failure and has been associated with lactic acidosis in patients on metformin.

acidosis is a condition caused by too much lactate in the blood. It is a rare but serious complication that can occur due to increased levels of metformin in the blood; when it occurs, it is fatal in approximately 50% of the cases.³ The increased levels of metformin occur because the metformin cannot be effectively removed from the blood by the damaged kidneys.

Patients undergoing studies involving iodinated radiographic contrast media

should have metformin temporarily withheld just prior to and 48 hours after the completion of the procedure. Metformin is reinstituted only after normal renal function is confirmed.

Metformin was approved by the FDA in 1994 for treatment of type II diabetes. This popular oral drug is a member of a class of drugs called biguanides that helps lower sugar levels by improving the way the body handles insulin. This is

done by preventing the liver from making excess glucose and by making muscle and fat cells more sensitive to available insulin.

Process

Our multi-disciplinary team consisted of the director of pharmacy, director of radiology, pharmacy informatics manager, clinical informatics coordinator, and a CT technologist. This team gave us an excellent breadth of knowledge needed to accomplish our goal.

In order to develop the decision support rule, the following information was needed in the rule:

Imaging Svc Contrast Questionnaire Hx - Jennie, Testpatient

*Performed on: 08/26/2009 0926 By: Chapman, Joseph

Imaging Service Contrast/History Questionnaire

Imaging Service Contrast

Information Obtained From

☐ Patient ☐ Father ☐ Legal Guardian
☐ Spouse ☐ Sister ☐ Grandparent
☐ Significant Other ☐ Brother ☐ Care Provider
☐ Friend ☐ Daughter ☐ Unable to Obtain Information
☐ Mother ☐ Son ☐ Other:

1. Why are we doing this exam?

2. What surgeries have you had?

3. Do you have a history of cancer or multiple myeloma?
☐ Yes ☐ No ☐ NA

Creatinine Level R **GFR** **Creatinine/GFR Date** R

4. Is patient a diabetic? ☐ Yes ☐ No ☐ NA

5. Are you taking a medication that contains metformin for any reason other than diabetes?
☐ Yes ☐ No

6. Do you have kidney problems? ☐ Yes ☐ No ☐ NA

7. Do you have asthma? ☐ Yes ☐ No

8. Do you have hypertension? ☐ Yes ☐ No

9. Have you ever had an exam in which IV contrast was given?
☐ Yes ☐ No ☐ NA

In Progress

Figure 1 • Electronic version of 15 questions of patient contrast/history questionnaire.

Figure 2 • Electronic version of 15 questions of patient contrast/history questionnaire.

- **National Drug Code (NDC).** The bar code on the side of the iodinated contrast product represents the NDC. An acceptable NDC has 11 characters. Often times, the bar code is more or less than 11, so it may not be the actual NDC, but represents the NDC. Regardless, the bar code on the product is unique and represents that particular contrast.
- **Patient's medical record number (MRN).** The MRN was used, as this number is unique to the patient and never changes. This tracking method is also important in the event a discharged ER patient would be admitted to the hospital as an outpatient.

- **Listing of all metformin-containing drugs in our formulary.**
- **Forty-eight hour period.** Metformin must not be administered within the 48 hour time period after the completion of the procedure.

The computer used is a thin client notebook computer that can run on a lithium ion 12 cell battery. The computer sits on a variable height roll stand with

foot pedal height control for the laptop tray and is next to the CT scanning table.

Prior to starting the exam, a patient fills out a contrast/history questionnaire. In an effort to save time, the questionnaire is in a paper version and is handed to the patient to be filled out when they check in to the radiology reception area. The 15 questions answered by the patient are then charted into the computer version (see Figures 1, 2, and 3).

The medical record number was used, as this number is unique to the patient and never changes.

Imaging Svc Contrast Questionnaire Hx - Jennie, Testpatient

Performed on: 08/26/2009 0934 By: Chapman, Joseph

Imaging Service: ☐ Yes ☐ No ☐ NA

Diabetic Medication: ☐ Yes ☐ No

Metformin Medication: ☐ Yes ☐ No

Cancer Information: ☐ Yes ☐ No

IV Contrast Information: ☐ Yes ☐ No

Allergies: ☐ Yes ☐ No

Medication History: ☐ Yes ☐ No

Kidney History: ☐ Yes ☐ No

Additional Contrast: ☐ Yes ☐ No

Peripheral IV Assessment: ☐ Peripheral IV Present ☐ Central Line Present ☐ Implanted Port Assessment

Central Line Assessment: ☐ Central Line Present

Implanted Port Assessment: ☐ Implanted Port Assessment

Type of Contrast: ☐ Magnevist ☐ Omnipaque 300 ☐ Visipaque 320 ☐ Ultravist 370 ☐ Multihance ☐ Omnipaque 350 ☐ Isovue-M 300 ☐ Other: ☐ Omnipaque 240 ☐ Visipaque 270 ☐ Reno-60

Amount of Contrast (ml): mL

Protocol Followed Regarding Contrast: ☐ Contrast Given According to Standard Protocol ☐ Variation of Clinical Standard Protocol ☐ No Contrast Was Given

Technologist:

Additional Contrast Exam Today: ☐ Additional Contrast Exam Today

If variation of protocol, enter appropriate orders

Remind patient not to breastfeed for 48 hours after contrast

Figure 3 • Electronic version of 15 questions of patient contrast/history questionnaire.

Once the results are charted, they can then be viewed at any time by medical staff in the electronic medical record (EMR) (see Figure 4).

After the patient is placed on the exam table, the patient's arm band is scanned with the bar coding gun, then the NDC bar code on the iodinated contrast product is scanned. After this is completed, the patient's medication history, located in the pharmacy database, is referenced. If the patient is on metformin, an alert will flash on the computer screen to alert the CT technologist that the patient is on metformin and a rule appears to discon-

tinue the medication for 48 hours (see Figure 5).

In the pharmacy department, if the patient is admitted through the ER and had a CT scan with contrast, the pharmacist will see an alert when entering metformin (see Figure 6). Based on the alert, the pharmacist will hold metformin per our pharmacy and therapeutic committee

approved protocol until normal renal function is confirmed.

Conclusion

We went live with our bar coding process on July 7, 2009. While it is too early to determine the success of our project, we have addressed an issue with a hardwired

Once the results are charted they can then be viewed at any time by medical staff in the EMR.

The screenshot shows an EMR interface with a menu bar (Task, Edit, View, Time Scale, Options, Help) and a toolbar. The main content area displays a questionnaire for a patient. The questionnaire is organized into sections: Imaging Services, Patient History, and Orders. The results are displayed in a table with columns for different dates and times.

Results	8/25/2009 8:07	8/25/2009 8:02	8/25/2009 7:11	8/19/20
Imaging Services				
Patient is a Diabetic			No	
Patient Has Asthma			No	
Patient Has Kidney Problems			No	
Patient Has History of Cancer			No	
Patient Ever Received IV Contrast			No	
Patient's Surgical History			knee, shoulder	
Reason for Performing Exam			abd pain, check for diverticulitis	
Creatinine Level			0.7	
Amount Of Contrast			75 mL	
Type Of Contrast			Omnipaque 350	
Protocol Followed Regarding Contrast			Contrast Given According to Standard Protocol	
Technologist for Imaging Service			Freeman, Amanda	
Patient Has Hypertension			No	
Hospitalized w/Acute Illness Last 6month			No	
Takes Med w/Metformin (not for diabetes)			No	
ORDERS				
Dr Orders Lab				
Dr Orders/Progress Notes				Dr Orders/
CLINIC DOCUMENTS				
Family Practice Office Note				

Figure 4 • Example of how the contrast/history questionnaire looks in the EMR.

process that has allowed us to enhance our patient safety. While we have implemented this process for ER patients and recently expanded the process to outpatients, we also plan to incorporate this process to the inpatient setting.

With the incidence of type II diabetes increasing, the use of metformin containing drugs should be expected to increase, raising the risk of the associated side effect between the interaction of iodinated contrast and metformin.

Jennie Edmundson Hospital would like to thank Toshiba America Medical Systems for their interest in patient safety by part-

nering with the AHRA and providing the Putting Patients First Program grant to make this project possible. ☘

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We have addressed an issue with a hardwired process that has allowed us to enhance our patient safety.

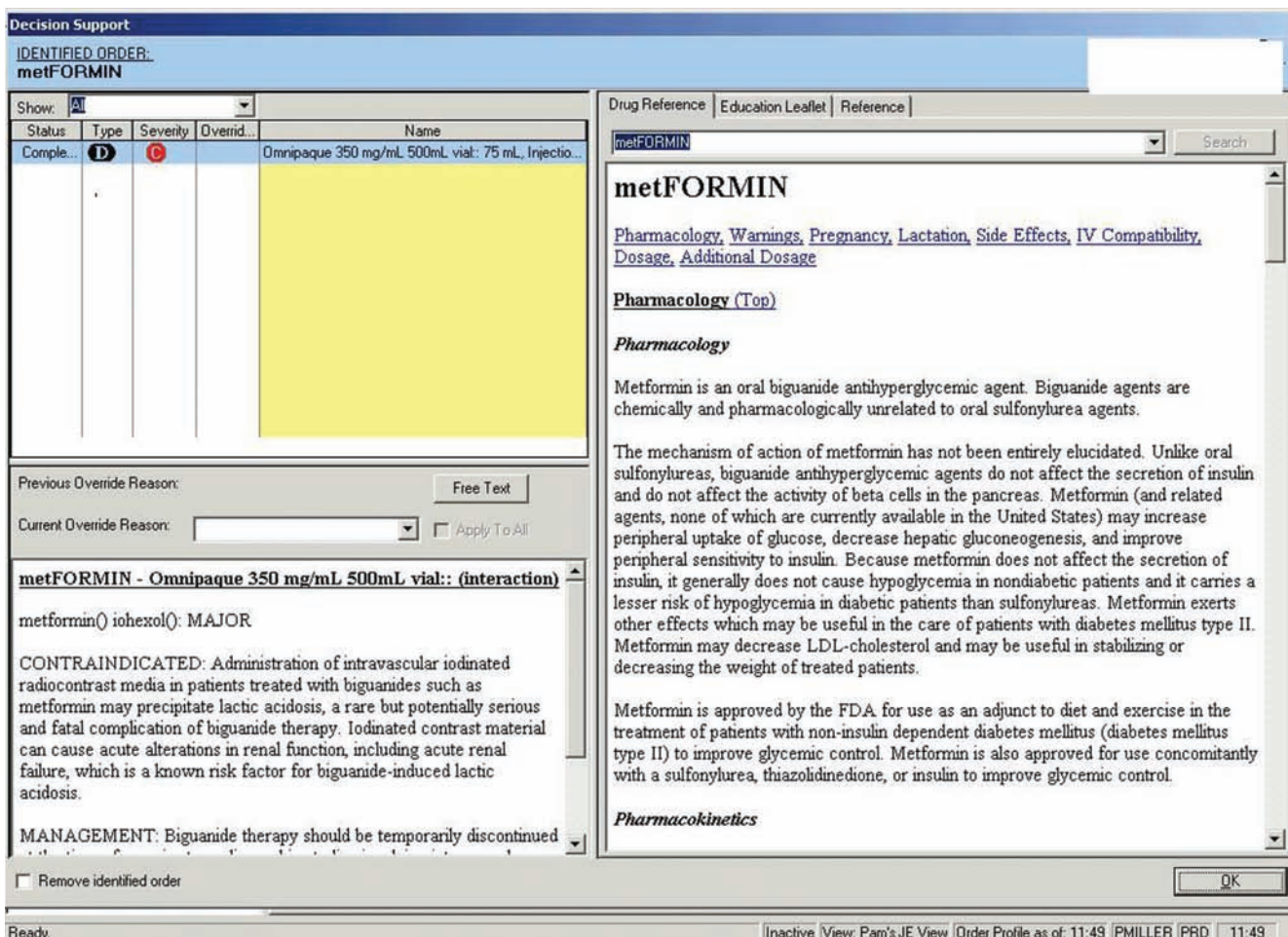


Figure 5 • Example of the alert based on the decision support rule that the CT technologist sees when a patient on metformin will receive iodinated contrast.



Figure 6 • Example of the alert that the pharmacist sees when filling an order for metformin on a patient admitted through the ER who received iodinated contrast.

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