Diabetes Issue: Medications vs. Supplements
Contents

**SO SAID...**

Leah - Texas native with a love of pharmacy. Get to know the TSHP Education & Communication Manager.

**FEATURE**

TSHP Research & Education Foundation 2015 Poster Competition

**TALK CLINICAL**

Friend or Foe? Cinnamon and Chromium Use in Diabetics

High Risk Medication Use in the Elderly Is Glyburide All that Bad for the Diabetic Geriatric Patient?

**TSHP Editorial Advisory Board 2014-2015**

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Cinnamon and Chromium Use in Diabetics: Friend or Foe?

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Phung (Kim) Nguyen, Pharm.D., BCPS, Clinical Pharmacy Manager, Cigna-HealthSpring

Introduction
The American Diabetes Association (ADA) released new research in 2013 estimating the total costs of diagnosed diabetes rose to $245 billion in 2012 from $174 billion in 2007. The largest components of medical expenditures found included prescription medications to treat complications of diabetes (18%) and the use of antidiabetic agents and diabetes supplies (12%). This data provides information on the substantial burden that diabetes imposes on society. Of the projected 168 million hospital inpatient days in the U.S. in 2012, an estimated 43.1 million days (25.7%) are incurred by people with diabetes of which 26.4 million days (61%) are attributed to diabetes complications. The population aged 65 years and older uses a substantially larger portion of services, especially hospital inpatient days, nursing/residential facility days, and hospice, compared with those less than 65 years of age. Old adults with diabetes also have the highest rates of major-lower extremity amputation, myocardial infarction (MI), visual impairment, end-stage renal disease, and death from hyperglycemia crises. Preventive and delayed strategies for type 2 diabetes can be efficiently implemented in clinical settings and in the community to avert complications of diabetes.

Strategies for managing diabetes include lifestyle modifications, dietary changes, and pharmacologic treatment. As healthcare professionals, it may be very challenging to have success with diabetics altering their diet and exercise regimens. Studies have shown that fewer than 40% of diabetics eat within 20% of prescribed diet and noncompliance rates for exercise are as high as 85%. Diabetic patients often times seek dietary supplements to aide in managing their condition rather than altering diet and/or exercise regimens. By taking the initiative to use dietary supplements, diabetics may feel as if they are playing an active role in managing their personal health, and therefore feel that they can avoid the prescribing of antidiabetic medications. One-third of individuals with diabetes may use alternative medicine and only one-third of those individuals who use these supplements inform their healthcare providers. Because individuals are seeking the use of dietary supplements, it is important as healthcare professionals...
to familiarize ourselves with current literature in order to assess their potential benefits. This article will focus on understanding how dietary supplements, particularly cinnamon, may provide assistance in the management of diabetes.

Potential Mechanisms of Cinnamon
The use of cinnamon as a dietary supplement for diabetics is due to the hypothesis that it may be able to lower serum lipids and blood glucose. Due to its possible benefits, cinnamon has been considered as a potential adjunct to current pharmacologic treatment in managing diabetes. The exact mechanism of cinnamon is poorly understood, but involves defects in the insulin signaling pathway. These initial findings have encouraged researchers to discover the possible advantage of cinnamon use in human clinical trials.

Anderson suggested that cinnamon’s most active ingredients are A-type doubly linked procyanidin oligomers of the flavonoid catechins and epicatechins. Results from several in vitro experiments support the proposal that cinnamon polyphenols mimic insulin action through numerous mechanisms. Procyanidins have been reported to have varying antihyperglycemic actions and studies have offered varying hypotheses for the action of cinnamon. Treatment with cinnamon polyphenols in rat adipocytes were shown to activate insulin receptors by increasing insulin receptor phosphorylation and decreasing inactivating protein tyrosine phosphatase (PTP-1), thus overcoming insulin resistance. Cellular glucose uptake has been found to be enhanced by cinnamon, causing the increased amounts of insulin receptor (IR)-β, IR-substrate-1 (IRS1), and glucose transporter-4 (GLUT4). Figure 1 provides a visual for the proposed mechanism of cinnamon. Cao also found that an increased expression of anti-inflammatory protein tristetraprolin may be involved in the prevention of inflammation. Cinnamon also appears to reduce hyperglycemia and inflammation through delayed gastric emptying, reducing excess postprandial glucose and triglycerides which induce cellular inflammation through increased C-reactive protein and cytokines. The proposed mechanisms of cinnamon have eluded to exploration of its potential benefit in managing diabetes.

Effectiveness of Cinnamon in Managing Diabetes
The first clinical trial that evaluated the effect of cinnamon in type 2 diabetics was conducted in Pakistan. Khan et al. studied the effect of cinnamon in type 2 diabetics on glucose, triglycerides, total cholesterol, high-density lipoprotein (HDL), and low-density lipoprotein (LDL). Inclusion criteria involved those with a diagnosis of type 2 diabetes, at least 40 years old, not taking insulin or other medications for other health conditions, and fasting blood glucose of 140-400 mg/dL. All subjects were taking sulfonylurea drugs and medications did not change during the study. Sixty individuals were randomized to six groups: one, two, and three were given 1, 3, or 6 g of cinnamon daily and groups four through six received placebo. After 40 days, significant reductions in fasting serum glucose, triglyceride, LDL, and total cholesterol were noted in all cinnamon groups. It has been suggested that because subjects were also taking sulfonylurea drugs and medications did not change during the study. Sixty individuals were randomized to six groups: one, two, and three were given 1, 3, or 6 g of cinnamon daily and groups four through six received placebo. After 40 days, significant reductions in fasting serum glucose, triglyceride, LDL, and total cholesterol were noted in all cinnamon groups. It has been suggested that because subjects were also taking sulfonylurea drugs and medications did not change during the study. Sixty individuals were randomized to six groups: one, two, and three were given 1, 3, or 6 g of cinnamon daily and groups four through six received placebo. After 40 days, significant reductions in fasting serum glucose, triglyceride, LDL, and total cholesterol were noted in all cinnamon groups.

Mang et al. found that cinnamon significantly decreased fasting plasma glucose by 10.3% vs. 3.4% in placebo (p = 0.046). The study included 79 Germans and lasted for four months. Inclusion criteria consisted of those with...
a diagnosis of type 2 diabetes, and patients could be treated only with oral antidiabetics or diet. Participants received cinnamon extract powder 3 g daily or placebo. Baseline characteristics showed that subjects were taking metformin (27.7%), sulfonylureas (12.3%), glinides (1.5%), glitazones (1.5%), combination (30.8%), and diet and/or exercise alone (23.1%). Results indicated no significant changes occurred in hemoglobin A1c (A1c) yet baseline A1c was 6.7-6.9%.

Vanschoonbeek et al. performed a cinnamon study in 25 Dutch postmenopausal women that lasted for six weeks. Inclusion criteria consisted of a diagnosis of type 2 diabetes, use of oral blood glucose-lowering agents, no liver or renal impairment, no cardiovascular disease, and no insulin use. Subjects received C. cassia (Cinnamomum cassia) 1.5 g daily or placebo. Baseline characteristics showed that common medications taken included sulfonylureas (56%), thiazolidinediones (24%), metformin (12%), and diet only (16%). No significant changes in A1c or lipids were seen. It is important to note that baseline A1c was well controlled in both groups, 7.1% in placebo and 7.4% in cinnamon.

Blevins et al. was the first U.S. study performed to evaluate the effects of cinnamon in individuals with type 2 diabetes where no significant changes were found in fasting glucose, lipid, A1c, or insulin levels (Table 1). The study included 58 participants, 51% women, 68% Caucasian, 16% Native American, 7% African American, 4% Hispanic, 2% Asian, and 3% of unknown ethnicity. Inclusion criteria consisted of diagnosis of type 2 diabetes, any age, no insulin use, and A1c ≥ 6.1%. Medications used included metformin (75%), thiazolidinediones (33%), and statins (50%). The results revealed no significant changes and the mean A1c at baseline was 7.1-7.2%.

It is unknown whether the trials discussed in Table 1 were performed in the primary care setting. Crawford set out to provide clarity in the conflicting results of whether cinnamon lowered glucose or A1c in the primary care setting. A total of 109 type 2 diabetics (A1c >7%) obtained from three primary care clinics in the U.S. were randomized to receive cinnamon 1 g capsules daily for 90 days or their usual care. Results showed that cinnamon lowered A1c by 0.83% when compared with usual care alone (p <0.04). The authors noted in the discussion of the study that the UK Prospective Diabetes Study (UKPDS 33) showed a reduction in A1c from 7.9% to 7% lowers the risk of macrovascular disease by 16%, retinopathy 17-21%, and nephropathy 24-33%; thus, a drop in A1c of 0.83% observed in Crawford’s study might yield similar reductions in morbidity.

### Table 1. Randomized Controlled Trials Evaluating the Effect of Cinnamon in Diabetics

<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Duration</th>
<th>Study Groups</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khan et al., 2003</td>
<td>60 Pakistani adults (30 men and 30 women) aged 52.2 ± 6.32 years</td>
<td>40 days</td>
<td>1, 3, or 6 g/day of Cinnamomum cassia daily or placebo</td>
<td>All three levels of cinnamon reduced fasting serum glucose (18-29%), triglyceride (23-30%), LDL (27%), and total cholesterol (12-26%) significantly</td>
</tr>
<tr>
<td>Mang et al., 2006</td>
<td>79 German adults</td>
<td>4 months</td>
<td>Cinnamon extract powder 3g daily or placebo</td>
<td>Cinnamon significantly decreased fasting plasma glucose by 10.3% vs. placebo 3.4% (p=0.046)</td>
</tr>
<tr>
<td>Vanschoonbeek et al., 2006</td>
<td>25 Dutch postmenopausal women aged 62.9 ± 1.5 years</td>
<td>6 weeks</td>
<td>C. cassia 1.5 g daily or placebo</td>
<td>No significant change in A1c or lipids</td>
</tr>
<tr>
<td>Blevins et al., 2007</td>
<td>58 U.S. adults (63.6 years of age in cinnamon group vs. 58 years of age in placebo group, p = 0.04)</td>
<td>3 months</td>
<td>C. cassia 1 g daily or placebo</td>
<td>No significant change in fasting glucose, A1c or lipids</td>
</tr>
</tbody>
</table>

LDL = LOW-DENSITY LIPOPROTEIN
this trial may have been more successful than previous studies due to the larger sample size and enrolling type 2 diabetics who were poorly controlled. Though some studies have shown statistically significant results favoring the use of cinnamon, the various study designs limit the ability to apply results to patient care with a specific dose and duration.

Additional Supplement Thought to Benefit Diabetics

Chromium

Chromium has shown positive effects in type 1, type 2, and gestational diabetes. Dietary forms of chromium include whole grains, green vegetables, meats, nuts, egg yolks, and certain beers and wines. The most concerning issue with chromium is that there is insufficient information to determine if an individual is deficient and how much supplementation would be required to provide benefit. A randomized, double-blinded, placebo-controlled trial performed in 180 Chinese patients, were given placebo, 200 mcg/day or 1000 mcg/day of chromium for 4 months. Results showed that fasting glucose was 128 mg/dL in the 1000 mcg/day group (p < 0.05 vs. the other two groups). A1c was 8.5%, 7.5%, 6.6% in the placebo, 200 mcg/day, and 1000 mcg/day groups, respectively. Since then, a meta-analysis was performed analyzing randomized controlled trials with the use of chromium which reported that data was inconclusive and more studies were needed to fully evaluate the role of chromium in diabetes. Even though the Chinese study showed great benefit, critics state that these results cannot be extrapolated to other populations.

Conclusion

The limitation of clinical trials and conflicting results do not allow a clear reasoning for the use of cinnamon in type 2 diabetics. Population characteristics varied among the trials including postmenopausal women, comorbidities, use of antidiabetic medications and healthy adults. Variables measured within each study were inconsistent to establish the ideal population who could potentially benefit from the use of cinnamon. It should be noted that the range of cinnamon doses also varied amongst the trials. The short duration for most of the trials performed does not accurately determine blood glucose management. In future studies, these factors would need to be controlled in order to possibly see a clear answer on the potential benefit of cinnamon.

Likewise, studies for the use of other dietary supplements do not provide any clarity to indicate they should be recommended in the management of diabetes. Because of this, it is strongly recommended by the ADA to stress diet, exercise, and pharmacologic treatment with agents proven to show benefits. It is essential as pharmacists to help manage risk factors, prevent complications of diabetes, and encourage patients to comply with each of these treatments in order to see concrete results in the management of their diabetes.

REFERENCES

9. Jarvill-Taylor KJ, Anderson RA, Graves DJ. A hydroxychalcone derived from cinnamon functions...


This year the poster competition boasted more than 100 submissions in 6 categories. TSHP takes the time each year to highlight our best submissions; the winners of the 2015 Poster Competition, so without further adieu...the winners are:

**PRACTITIONER – ADMINISTRATIVE CATEGORY**

**WINNER:** Evaluation of Adverse Drug Events Utilizing the Trigger Tool Method  - VIEW POSTER
M Anderson, J Parma, N Pham
Memorial Hermann Southeast Hospital, Houston, TX
Background: Adverse drug events (ADEs) are a response to a drug that is noxious and unintended, which occurs at doses used in man for prophylaxis, diagnosis, therapy, or modification of physiologic function. ADEs are associated with significant healthcare costs and can result in harm or death of a patient. There is significant under-reporting of ADEs; however, the use of a “trigger” may complement the typical method of identifying and reporting potential ADEs.

Methods: Analyze the utility of “triggers” in identifying ADEs through review of current ADE reporting using the traditional method, performing an evaluation of potential ADE identification through trigger medications, and implement daily review of “triggers” in pharmacists’ workflow to increase ADE reporting.

Results: Nineteen ADEs were reported for 2013 and 2014 using the hospital’s traditional electronic reporting system. In December 2014, trigger medication review identified 34 ADEs amongst 21 inpatients. Implementation of a trigger medication report resulted in February 2015 resulted in identification of 29 ADEs.

Conclusion: ADEs were significantly under-reported using the hospital’s electronic reporting system. In December 2014, 34 ADEs were identified following evaluation of trigger medications; none of these ADEs were reported through the electronic reporting system. Following implementation of a trigger medication report in February 2015, 29 ADEs were reported. This was more ADEs than were reported in the previous two years.

Disclosures: Authors of the presentation have nothing to disclose.

HONORABLE MENTION: Increasing ADE Reporting using EMR Trigger Tool - VIEW POSTER
AJ Ries, JS Hooper, AB Martin
Mother Frances Hospital, Tyler, TX

Click the image for a larger view.
Background: Adverse drug event (ADE) reporting often relies on spontaneous reporting by health care professionals. At our facility, through the electronic chart, pharmacists can incorporate spontaneous ADE reports into daily patient care activities. However, these reports are often limited to events noted through pharmacy activities. In addition, under-reporting remains a significant barrier to accurate quantification of ADEs in an individual facility.

Objective: To develop a systematic method to capture ADEs, particularly related to high-risk medications, and more accurately identify and quantify ADEs within our facility.

Methods: Using documentation from the electronic chart, a tool was implemented to capture ADEs related to the administration of specific trigger medications. This tool uses In-Basket functionality to alert the administrator when a trigger medication is administered. This specific patient chart is retrospectively reviewed to determine if the trigger medication was given as the result of a medication-related event. Best Practice Advisory functionality is used to document alerts that are confirmed as ADEs.

Results: The trigger tool was implemented in November 2013 with nine trigger medications. Prior to implementation, mean ADE detection rate was 16±3 events per month. After implementation, overall ADE reporting increased 4.5 fold to 67±10 events per month (p <0.001). Specifically, reporting of hypoglycemic reactions increased from zero events to approximately 18 events per month.

Conclusions: Implementing a trigger tool methodology has helped identify key medication safety problems through better event identification and quantification. Additionally, events identified through this method are more robust and less sensitive to bias inherent in other reporting methods.

Disclosures: The authors have nothing to disclose.

PRACTITIONER – CLINICAL CATEGORY

WINNER: Prospective Pharmacist Review of Emergency and Procedural Orders (Autoverify-Review)

R Martin
Texas Health Harris Methodist Alliance Hospital

Background: Currently, The Joint Commission requires that a pharmacist prospectively review all medication orders except emergency medications or medications given in a procedural area. Historically, pharmacists have not attempted to prospectively review these medication orders due to fear of delaying patient care. Consequently, electronic health records typically allow these medication orders to “auto-verify” without a pharmacist review.

Objective: To improve patient safety by enabling pharmacists to prospectively evaluate emergency and procedural medication orders without delaying patient care.

Methods
- Using the EPIC electronic health record, those orders set to “autoverify” were set to “review-autoverify”.
- This change allowed medication orders to autoverify and transmit to automated dispensing cabinet, while simultaneously prompting the pharmacist order verification screen in real time.
- If an intervention was needed, the pharmacist would contact the nurse staff to prevent administration or the medication in question.
**Objective:** To enable pharmacists to prospectively evaluate emergency and procedural medication orders and make critical interventions without delaying patient care.

**Methods:** Using the EPIC electronic health record, those orders set to “auto-verify” were set to “review-auto-verify”. This change allowed medication orders to auto-verify and transmit to automated dispensing cabinet, while simultaneously populating the pharmacist order verification queue in real time. If an intervention was needed, the pharmacist would contact the nurse directly to prevent administration of the medication in question.

**Results:** In 2014, our pharmacists spent 951 additional hours processing 150,405 emergency and procedural (auto-verify-review) orders. Of all auto-verify-review medication orders processed, 42% were verbal or secondary orders by non-prescribers and 26% were for drugs listed on the ISMP 2014 High Alert Drug List. The program averted 23 adverse drug events in a 6 month period with a total cost avoidance estimated at ~$400,000/year.

**Conclusions:** Our data suggests that a significant fraction of the emergency and procedural medication orders are high alert drugs and input by non-prescribers, posing a significant risk to patients. With improvements in technology and wide implementation of CPOE, pharmacists should explore new ways of improving safe medication use in emergency and procedural settings.

**Disclosures:** The authors have nothing to disclose

**HONORABLE MENTION: Pharmacist-selected perioperative antibiotic prophylaxis**

R Martin, Pharm.D.
Texas Health Harris Methodist Alliance Hospital

**Background:** 100% compliance with Surgical Care Improvement Project (SCIP) guidelines concerning timing and selection of perioperative antibiotic prophylaxis has been challenging for many institutions to achieve. Most quality programs to assure compliance rely on concurrent review and “just-in-time” interventions.

**Objective:** To improve SCIP guideline adherence through a protocol that enables the pharmacist to select and order antibiotic prophylaxis for all surgeries and procedures conducted at our facility.

**Methods:** Antimicrobial prophylaxis protocol was developed in collaboration between pharmacy, anesthesia, and surgeons. Pharmacists received a list of scheduled procedural cases 18 hours in advance and real time print outs for add-on surgical cases. Based on the procedure type and P&T approved protocol, pharmacists then selected and input perioperative antibiotics.

**Results:** Pharmacists spent approximately 45 minutes daily on this program. Since inception, the program has...
ensured 100% compliance with timing and selection of antibiotics. Hospital culture has also benefited significantly, creating a professional collaboration between surgeons, anesthesiologists, and pharmacists.

**Conclusions:** Pharmacists have the training and knowledge to effectively select antibiotics for peri-surgical prophylaxis, yet are underutilized. By utilizing pharmacists to select and order antibiotics, patient care has been improved and maintained.

**Disclosures:** The authors have nothing to disclose

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**PRACTITIONER – EDUCATIONAL CATEGORY**

**WINNER: A Case Based Ethics Course in a Doctor of Pharmacy Program**

JT Copeland
University of the Incarnate Word, San Antonio, TX

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**Background:** Education in ethics is required for Doctor of Pharmacy degree program by the Accreditation Council for Pharmacy Education (ACPE). Additionally, ACPE strongly encourages using active learning strategies in the student’s education.

**Objective:** Describe methods used to incorporate case based studies into a course on ethics.

**Methods:** The original course design was lecture based with 1 to 2 case studies discussed at the conclusion of each class. Students yearly requested more case studies and less lecture in the end of course evaluations. The revised course focuses upon case study class discussions. In order to ensure students are prepared for the case discussions, students complete a graded, no note, individual quiz at the beginning of each class over the required recorded lectures or readings. Following the quiz, the instructor answers any questions. Students then discuss case studies in small groups followed by class discussions. Case study topics include research, cultural competency, social justice, medicine, finances, beginning of life, and end of life. The case studies allow the students to actively participate in solving real world pharmacy ethical dilemmas. Rather than furnishing case studies in cultural competency, the small groups write case studies and exchange the studies with other groups for analysis and discussion.

**Results:** The methods are well received by students. Students continue to indicate that case studies are highly beneficial in the end of course evaluation.

**Conclusions:** Authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter discussed in the presentation.
**Results:** The methods are well received by students. Students continue to indicate that case studies are highly beneficial in the end of course evaluation.

**Conclusions:** The methods used continue to be employed. As new topics emerge, case studies will be developed to address those dilemmas.

**Disclosure:** none

**HONORABLE MENTION: Development of a Teaching Certificate Program by a PGY-1 Pharmacy Residency in a Non-Academic Setting**

K Purcell  
Baptist Health System, San Antonio, TX

**Background:** Many residencies provide a teaching certificate, particularly at academic medical centers and through a pharmacy school partner. A lot of pharmacy students that are pursuing residency desire to get experience teaching and ask about this during the recruitment and interview process.

**Objective:** To develop an optional teaching certificate program as a longitudinal learning experience for a PGY-1 pharmacy residency in a non-academic setting.
Methods: A list of requirements that must be completed was established and grouped into learning, teaching, and reflecting activities. The program design incorporated all elements described in an ACCP white paper on resident teaching experiences. A checklist was created to document completion of the required activities in the teaching certificate program section of the resident notebook. A quarterly self-assessment and evaluation form was crafted to monitor resident progress with achievement of the assigned learning objectives. A preceptor and learning experience quarterly evaluation form was crafted for the residents to provide feedback on this longitudinal learning experience.

Results: The teaching certificate program was offered for the first time during the 2014-2015 residency year. One resident elected to complete the optional teaching certificate program. Feedback on all aspects of the teaching certificate program has been very good thus far and no revision is planned for the next residency year. BHS will issue the teaching program certificate along with the residency graduation certificate at the end of the residency.

Conclusions: A teaching certificate program can be designed and implemented by preceptors for a PGY-1 residency in a non-academic setting.

Disclosure: The author has nothing to disclose.

STUDENT CATEGORY

WINNER: Risk Factors for Recurrent Clostridium difficile Infection: A Retrospective Cohort Study of the United States Veterans Health Care System

SM Allen, MC Cowley, KR Reveles
The University of Texas College of Pharmacy, Austin, Texas
The University of Texas Health Science Center at San Antonio, San Antonio, Texas

Background: Clostridium difficile infection (CDI) recurrence is a major public health concern; however, associated risk factors are not well understood.
Objective: To identify independent risk factors for recurrence among adult Veterans Health Administration (VHA) patients nationwide over a 10-year period.

Methods: This was a retrospective cohort study of CDI patients receiving care at any VHA hospital or clinics in the U.S. from 10/1/2002 to 06/30/2012. Eligible cases included patients ≥18 years of age who had an ICD-9-CM code for CDI (008.45). We tested 38 patient characteristics for their association with 60-day recurrence using bivariable analyses. We then performed a backward stepwise logistic regression model, retaining only variables with a p-value <0.0001 in the final model.

Results: Overall, 62,181 patients met inclusion criteria. Patients had a median (IQR) age of 69 (60-79), were predominantly white (75%) and male (96%). There were 16,141 60-day CDI recurrences (26%). Bivariable analyses revealed 33 variables significantly associated with 60-day CDI recurrence. In multivariable models, eight variables remained independently associated with recurrence including: community-associated CDI (CA-CDI) (OR 2.04; 95% CI 1.95-2.04), community-onset, healthcare facility-associated CDI (CO-HCFA-CDI) (OR 1.93; 95% CI 1.84-2.02), principal CDI diagnosis (OR 1.63; 95% CI 1.56-1.70), HIV/AIDS (OR 1.38; 95% CI 1.21-1.57), concomitant gastric acid-suppressing (GAS) drugs (OR 1.14; 95% CI 1.08-1.19), dyslipidemia (OR 1.13; 95% CI 1.09-1.17), concomitant antibiotics (OR 1.12; 95% CI 1.08-1.16), and renal disease (OR 1.11; 95% CI 1.06-1.16).

Conclusions: Several patient-specific factors increase the risk for CDI recurrence. These patients may be preferentially targeted for preventative interventions.

Disclosures: All authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.

HONORABLE MENTION: Initiative to Promote Medication Safety through Standardization of Pyxis Station Drawer
T Nguyen, D Dozier, L Roes
The University of Texas College of Pharmacy, Austin, Texas
The University of Texas MD Anderson Center, Houston, Texas
Background: At MD Anderson Cancer Center, many anesthesiologists and certified registered nurse anesthetists rotate between different areas of the hospital. The locations of medications in the Pyxis MedStations are not consistent between all areas, which can create a potential for medication errors and increase in health care costs.

Objective: To analyze medication use from the Pyxis MedStations and promote consistency between stations in different areas of the hospital in order to minimize the potential for medication errors and cost.

Methods: A report was generated for all Pyxis MedStation transactions between January 1, 2014 to June 17, 2014 in seven areas of the hospital through which anesthesiologists and certified registered nurse anesthetists rotate. The frequency of use and indication of each medication were used to guide decisions in removing or rearranging drugs in the Pyxis MedStation.

Results: Various drugs, including acetylcysteine, amiodarone, metoclopramide, and propranolol, were removed from the Pyxis MedStation due to low use or duplicate therapy. Many drugs were rearranged to promote consistency between the different areas of the hospital. Figures will be included on the poster to reflect the changes in the Pyxis MedStation configurations.

Conclusion: Evaluating medication use in an important quality improvement process. Pharmacists and administrators play a pivotal role in medication management and safety. Assessing the use and supply of each medication is important to improve work flow, minimize costs, and provide quality patient care.

Disclosure: All authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.
Background: Medication errors during care transition, including hospital admission, can lead to adverse drug events. This problem becomes more challenging with the advancement of electronic medical record (EMR), due to its complexity.

Objective: Assess the outcomes of a pharmacy technician-centered program where prior to admission (PTA) medication history was completed in EMR by a trained certified pharmacy technician (CPhT) versus registered nurses (RNs)

Methods: This prospective observational study was conducted from August to September 2014 at CHI St. Luke's Health The Woodlands Hospital, a 215-bed acute care community hospital. Inclusion criteria were patients older than 18 years and admitted through emergency department within 72 hours. Pharmacists audited 28 patients’ medication histories (255 medications) documented in EMR by RNs and 29 patients’ medication histories (255 medications) documented by a trained CPhT. Pharmacists verified the accuracy of medication history from two reliable sources. Descriptive statistical analyses were performed.

Results: An error rate of 44% was found in the medication histories obtained by RNs versus 7% error rate in the medication histories obtained by the CPhT (p = 0.001). On average, each patient had eight PTA medications, and the CPhT completed two patients’ medication histories per hour. Consequently, more than 12,000 medication errors can be avoided annually, with potential cost avoidance exceeding $244,000.

Conclusions: A CPhT-centered program significantly reduced the error rate in PTA medication history and facilitated admission medication reconciliation process. This initiative demonstrated success in improving accuracy during care transition with pharmacy personnel involvement.

Disclosures: All authors have nothing to disclose.

HONORABLE MENTION: Optimizing Medication Reconciliation by Utilizing Pharmacy Technicians
TB Moss, JJ Connor, AM Hopkins, NS Myers
Methodist Charlton Medical Center, Dallas, Texas

Background: In order to achieve a more accurate medication list for patients coming into Methodist Charlton, pharmacy technicians were staffed in the Emergency Department (ED) to start in-taking home medication lists of patients. Previous to this program, Methodist Charlton pharmacists were clarifying/correcting at least one in every three med rec orders due to their inaccuracy.

Objective(s): The pharmacy technicians have a goal of completing home medication lists on at least 75% of ED admits within 24 hours of admitting time with an accuracy rate of at least 90%.
Method(s) or Procedure(s): Med rec techs are responsible for obtaining patient height, weight, allergies, allergy reactions, current medications – including drug name, strength, dose, and frequency, and time and date of last dose taken. The ED pharmacist performs quality assurance (QA) checks on medication lists by conducting random audits to check for accuracy which is done initially on a daily basis and monthly thereafter.

Result(s): Over the last 6 months, pharmacy technicians have completed home medication lists on 85% of ED admits within 24 hours of admitting time with an accuracy of 96%. They are completing an average of 28 home medication lists daily and an average of 18 interventions are performed on each home medication list completed.

Conclusion(s): The med rec techs have exceeded our goals of a 75% completion rate with 90% accuracy. The ability of pharmacy techs to educate patients and reinforce compliance with taking medications and discouraging poly-pharmacy has been an additional positive benefit of the program.

Disclosure(s): none

RESIDENT/FELLOW/POST-GRADUATE (PGY1) CATEGORY

WINNER: Evaluation of Pharmacokinetic Monitoring, Adverse Events and Complications in Patients Discharged on Intravenous Vancomycin or Aminoglycoside Therapies.

RJ Musgrove, M Green, AM Luce
Harris Health System, Houston, TX
Background: Outpatient intravenous antimicrobial therapy (OPAT) provides a convenient alternative to an extended hospital admission for patients requiring long-term antibiotic treatment. Many of these patients are discharged home on antibiotics associated with serious adverse events such as vancomycin or aminoglycosides. The Infectious Disease Society of America recommends therapeutic drug monitoring (TDM) for patients on OPAT. Currently there is no dedicated service monitoring patients on OPAT at Harris Health System.

Purpose: The purpose of this study is to assess OPAT at Ben Taub General Hospital (BTGH) and Lyndon Baines Johnson General Hospital (LBJGH) and identify the occurrence of TDM, adverse events and complications in patients discharged on IV vancomycin and aminoglycosides. Ultimately the goal of this project is to establish a clinic-based, pharmacist-led antimicrobial pharmacokinetic monitoring service for BTGH and LBJGH.

Methods: A retrospective chart review was conducted of patients discharged on vancomycin or an aminoglycoside from February 1, 2014, to July 31, 2014. Information collected from each chart included patient demographics, comorbidities, diagnosis, pavilion of discharge, antibiotic regimen and duration, levels and percent of levels within goal range and baseline labs such as serum creatinine (SCr) and complete blood count (CBC). Each chart was then analyzed for evidence of adverse events related to OPAT.

Results: A total of 200 patients were included in the study, with 65.5% (131) and 34.5% (69) discharged from BTGH and LBJGH respectively. The median age was 52 years in the TDM group and 49 in the non-TDM group. Bone and joint infections were the most common diagnoses (48%, n=96) followed by bacteremia (27.5%, n=55). Vancomycin accounted for 99.5% (199) of the prescribed antibiotics. One (0.5%) patient was discharged on tobramycin. The median duration of therapy was 42 days in the TDM group compared to 14 days in the non-TDM group. Of the 200 patients, 79 (39.5%) received TDM, while 121 (60.5%) had no drug levels drawn following discharge. In the TDM group, acute kidney injury (AKI) occurred in 17 (21.5%) patients, CBC abnormalities occurred in 19 (24%) patients, thrombosis occurred in 4 (5.1%) patients, readmission related to initial infection within 90 days occurred in 17 (21.5%) patients and 7 (8.8%) patients went to the emergency center (EC) for line-related problems. In the group that did not receive TDM, AKI occurred in 11 (9%) patients, CBC abnormalities occurred in 3 (2.5%) patients, thrombosis occurred in 2 (1.7%) patients, readmission related to initial infection within 90 days occurred in 16 (13.2%) and 20 (16.5%) patients went to the EC for line-related problems.

Conclusions: At first glance it appears that the group receiving TDM had a higher percentage of adverse events, particularly AKI and CBC abnormality (21.5% vs 9% and 24% vs 2.5%, respectively). However, it was the TDM that allowed for these events to be identified due to the fact that patient labs were being monitored. These events may have happened with more frequency in non-TDM patients, but were not detected because the patients’ labs were not being followed. EC visits for PICC line issues included clogged lines, replacements and removals. These visits occurred more in the non-TDM group than the TDM group (8.8% vs 16.5%). A limitation of this study is that it was not powered to detect a significant difference between groups. In conclusion, there were fewer EC visits for PICC line issues and more adverse events were identified in the TDM group.

Disclosures: Rachel Musgrove has nothing to disclose. Andrea Luce has nothing to disclose. Monica Green has nothing to disclose.

HONORABLE MENTION: Assessment of the Duration of Mechanical Ventilation and Outcomes in Cardiovascular Surgery Patients Receiving Crystalloids versus Patients Receiving Crystalloids and Albumin.
Quintin Broussard, Stephen Michaud, Miguel Salazar, BeeBee Hu, Kimberly Putney, Thuy Nguyen
CHI St. Luke’s Health – Baylor St. Luke’s Medical Center, Houston, TX.
Purpose: The primary objective is to determine if there is a difference in mechanical ventilation duration of cardiovascular surgery patients receiving crystalloids alone compared to patients who received albumin ± crystalloids for fluid resuscitation. Secondary objectives include determining if there are differences in hospital and ICU lengths of stay, usage of vasopressors at 24 hours post-surgery, and hospital mortality after 24 hours post-cardiovascular surgery in patients receiving crystalloids alone compared to patients receiving albumin ± crystalloids for fluid resuscitation. Studies comparing crystalloid versus colloid solutions have shown no significant differences in days of mechanical ventilation, length of hospital stay, morbidity, and mortality. However, these studies included heterogeneous patient populations or excluded certain patient populations, notably cardiovascular surgery patients.

Methods: This is a retrospective cohort observational study of treatment outcomes in hospitalized cardiovascular surgery patients receiving fluid resuscitation with crystalloids alone compared to patients receiving albumin ± crystalloids between January 2011 and June 2014.

RESULTS: Sixty-five patients who met inclusion criteria were included in the preliminary analysis. Forty-nine patients received albumin ± crystalloids, while 16 patients received crystalloids only. Median mechanical ventilation duration in the albumin ± crystalloids group was 7.6 hours versus 7.5 hours in the crystalloids alone group (p = 0.381). Median hospital length of stay was 8 days in both the albumin ± crystalloids and the crystalloids alone group (p = 0.820). Median ICU length of stay was 2 days in both groups (p = 0.337). Five patients in the albumin ± crystalloids group (10.2%) and one patient in the crystalloids alone group (6.25%) required vasopressor usage at 24 hours post-surgery (p = 0.608). There were no deaths in either group.

Conclusion: In the preliminary analysis, there were no statistically significant differences between cardiovascular surgery patients receiving albumin ± crystalloids compared to patients receiving crystalloids alone. Further data collection will be completed to validate the preliminary outcomes of cardiovascular surgery patients receiving albumin and crystalloids versus crystalloids alone.

Disclosures: none

RESIDENT/FELLOW/POST-GRADUATE (PGY2) CATEGORY

WINNER: Implementation of a Pharmacist-Run Post-Transplant Diabetes Clinic
DM Newland, RC Hall, PR Maxwell
Department of Pharmacy, University Health System, San Antonio, TX
Pharmacotherapy Division, College of Pharmacy, The University of Texas at Austin
Pharmacotherapy Education & Research Center, The University of Texas Health Science Center at San Antonio
Background: Post-transplant diabetes mellitus (PTDM) can lead to significant morbidity and cardiovascular death with a functioning graft. A paucity of literature exists regarding glycemic control in solid organ transplant (SOT) recipients, including pharmacist management of PTDM.

Objective: To assess the impact of pharmacist interventions on diabetes mellitus management in a pharmacist-run PTDM clinic.

Methods: A single-center, prospective, observational study is being conducted of SOT recipients aged 18 years or older who are enrolled in a pilot pharmacist-managed PTDM clinic from 01/2015 – 06/2015. The primary outcome is to assess change in hemoglobin (Hgb) A1C and average daily self-monitored blood glucose (SMBG) readings from enrollment to 3 months follow-up. Results: Thirty-four patients have been enrolled during the first two months of the pilot. The group includes 16/34 (47%) post-kidney, 10/34 (29%) post-liver, and 8/34 (24%) post-lung transplant recipients. The mean age is 56 (range 32-74) years and 62% are male; 53% are Hispanic and 38% are White. The baseline mean Hgb A1C was 9.2% (range 5.0-14.6%), and the mean daily SMBG was 207 (range 113-468) mg/dL. Pharmacist interventions thus far have included provision of diabetes self-management education for each patient, medication-specific adjustments, and 11 discontinuations. For 22 patients with a mean 21 days follow-up, the mean average daily (SMBG) readings have decreased by 30 mg/dL. Conclusion: Interim results suggest that pharmacist-managed PTDM clinics can positively impact glycemic control in SOT recipients.

Disclosures: None
Background: Adherence to the 2013 blood cholesterol guidelines changed the intensity of prescribed statins. Schoen, et al. reviewed patients in an ambulatory care setting and found 56% adherence to the 2013 blood cholesterol guidelines prior to implementation of the guidelines.

Objectives: This study assessed adherence to the 2013 blood cholesterol guidelines in a diabetic population, the number of patients on appropriate statin therapy, and adherence between physician and pharmacist visits in a PCMH.

Methods: Patients with diabetes between the ages of 40 to 75 without any contraindications to statin therapy were chart reviewed if they had an appointment with a pharmacist or physician between December 2013 and October 2014. Atherosclerotic cardiovascular disease risk was calculated to determine the appropriate intensity statin.
Results: 583 patients met the inclusion criteria. The appropriate intensity statin was prescribed in 32% (n=154) of patients in the physician group (n=475) and 35% (n=38) of patients in the pharmacist/physician group (n=108; P=0.58). Statin therapy was prescribed in 71% (n=338) of patients in the physician group and 88% (n=95) of patients in the pharmacist/physician group (P=0.003). The appropriate intensity statin in statin naïve patients was prescribed in 45% (n=59) of the physician group and 50% (n=16) of the pharmacist/physician group (P=0.61).

Conclusion: The appropriate intensity statin prescribed in all patients did not differ between patients managed by physicians compared to those managed by pharmacists/physicians. Overall adherence to the 2013 blood cholesterol guidelines was 33%, and this implies a baseline assessment of current adherence with the guidelines.

Disclosures: AJ Hinds, D Lopez, J Jokerst, K Rascati, M Srinivasa have nothing to disclose.

To view all of the abstracts for posters that participated in the 2015 R&F Foundation Poster Competition may be viewed by clicking this link.

The 2016 TSHP Research & Education Foundation Poster Competition will occur during the 2016 Annual Seminar in Frisco, TX.

The Competition is an opportunity for seminar registrants to submit and display original scholarly work in poster format in the following six categories:

- **Resident/Fellow/Post-Graduate** includes posters submitted by pharmacists enrolled in a post-graduate residency, fellowship or other post-graduate educational programs. The category is divided into two sub-groups: PGY1 and PGY2.
- **Student** incorporates posters submitted by students enrolled in pharmacy academic programs.
- **Technician** posters are those submitted by practicing pharmacy technicians and technician students.
- **Practitioner** posters are submitted by registered pharmacists in one of three categories:
  1. **Administrative/Practice Management** is related to professional practice management issues and leadership.
  2. **Clinical** is related to patient care delivery, therapy and outcomes.
  3. **Education** is related to patient, healthcare practitioner and community education and/or educational planning, development and conduct for professional practice.

Posters will be displayed during the Seminar, from Friday, April 22 through Saturday, April 23. Presenters will be available on Friday, April 22 from 5:00 PM to 6:00 PM to discuss their research.

Primary authors in each of the poster categories who comply with the requirements will be eligible to win a $250 award and a recognition certificate from the TSHP Research and Education Foundation. Winners will be recognized during the Opening Reception on Friday evening between 6:00 and 7:00 PM. Winners will also be featured in the TSHP Journal and the 2016 TSHP Research and Education Foundation Annual Report.

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Introduction
An estimated 10.9 million (26.9%) of all people aged 65 years or older have been diagnosed with diabetes mellitus in the United States (U.S.). The occurrence of diabetes has shown to increase until about the age of 65, after which time both frequency and prevalence seem to even out. The escalation of elderly diabetics within the U.S. population has been linked to increased rates in obesity; according to the Centers for Disease Control and Prevention (CDC), the prevalence of diabetes is estimated to double within the next 20 years and is believed to be, in part, due to the maturing population. Further forecasts suggest that, between the years of 2005 and 2050, diabetes within the elderly will increase by 4.5-fold when compared to 3-fold in the total population. Alarmingly, according to national surveillance diagnostic criteria (hemoglobin A1C [HbA1c] and/or fasting plasma glucose), approximately one-third of geriatric patients have undiagnosed diabetes. Within the geriatric population, diabetes is linked to higher rates of mortality, reduced functional status, and an increased risk for institutionalization. In addition, elderly patients with diabetes are at significant risk for cardiovascular events (such as myocardial infarction) as well as acute and chronic microvascular complications. When compared to younger counterparts, elderly diabetics have the highest rates of visual impairment, major lower-extremity amputation, and end-stage renal disease. Other negative effects that can impact the elderly diabetic include urinary incontinence, depression, and polypharmacy. Thus, it is imperative that appropriate...
treatment and lifestyle modifications begin as soon as the diagnosis is made to prevent increased incidence of morbidity and mortality. Physicians and pharmacists are tasked with suggesting lifestyle modifications and initiating pharmaceutical intervention(s) to help achieve glycemic control. However, choosing the right treatment course, especially in the elderly, is not always a simple task.

Currently, there are many hypoglycemic medications available on the market to treat type 2 diabetes. Available hypoglycemic agents, both oral and parenteral, include a biguanide, sulfonylureas, meglitinides, thiazolidinediones (TZDs), dipeptidyl-peptidase-IV (DPP-4) inhibitors, glucagon-like peptide-1 (GLP-1) receptor agonists, sodium/glucose co-transporter 2 (SGLT2) inhibitors, alpha-glucosidase inhibitors, bile acid sequestrants, and insulin. Each product has differing prandial targets, pre and/or post, varying degrees of HbA1 lowering, and side effect profiles. However, not all diabetic medications are appropriate for use in the elderly; product decision should be contingent upon the patient’s renal, liver and pancreatic function, as well as targeted HbA1c goals. Avoidance of hypoglycemic episodes is of great concern when managing elderly diabetic patients due to the prevalence of renal dysfunction that occurs with increasing age and type 2 diabetes. Falls and exacerbation of comorbid conditions can result from episodes of hypoglycemia, resulting in poorer outcomes and higher costs of care. As a result, certain medications, including some hypoglycemic agents, have been deemed inappropriate for use in the elderly population.

An estimated $7.2 billion in annual costs have been linked with inappropriate medication use in the elderly. To combat this epidemic, the Centers for Medicare and Medicaid Services (CMS) has devised a list of potentially inappropriate medications to be avoided in the elderly, adapted from measures developed and endorsed by the Pharmacy Quality Alliance (PQA) and the National Quality Forum (NQF). This list is a modified version of the Beers Criteria, an evidence-based guideline that not only catalogues medications that cause adverse drug events in older adults due to their pharmacologic properties, but also takes into account the physiologic changes that occur in aging. This criteria identifies certain medications that have been associated with putting the elderly at an increased risk for adverse drug events, potential toxicities, falls and/or fractures. CMS has taken this list of possibly detrimental medications or “high risk medications” (HRMs) in the elderly very seriously; the use of HRMs has been incorporated into CMS’s quality evaluation for Medicare health plans, known as the CMS Star measures for Part D. In short, a health plan is rated on a 1-5 scale based on quality performance measures, which are documented through observance of pharmacy claims data, and broken down by individual contracted prescribers within the health plan. This HRM measure is determined by the percent of Medicare Part D beneficiaries aged 65 years or older who received two or more prescription fills for the same HRM drug during the measurement period of 1 year. In 2012, glyburide was added to the Beers Criteria by the American Geriatrics Society (AGS), and is now part of the list of HRMs that can negatively impact the HRM measure, which is part of CMS Part D Star Quality Ratings.

This article will review the evidence-based guidelines for diabetic treatment in the elderly, how sulfonylureas fit into the picture, and will specifically address the metabolism, side-effects and concerns for glyburide use in the elderly population.

**Guideline Recommendations**

The American Diabetes Association’s (ADA) current recommended HbA1c targeted goal is < 7.0% in most patients to reduce microvascular complications. However, a less stringent HbA1c goal of 7.5-8.0% or higher may be appropriate for more frail patients who have a history of hypoglycemia, advanced microvascular and macrovascular complications, limited life expectancy, and long-standing diabetes despite intervention with glucose-lower agents, including insulin. Those with major comorbid illness and/or a life expectancy of < 5 years are unlikely to benefit from aggressive glucose-lowering management, and should have an HbA1c target between 8-9%. These goals and recommendations are also consistent with the AGS and the European Diabetes Working Party guidelines.

Metformin remains the most widely used first-line agent
for the treatment of type 2 diabetes. For elderly patients without contraindications (i.e. renal impairment), initial therapy with metformin is preferred as monotherapy along with lifestyle modifications. However, in elderly patients with contraindications and/or metformin intolerance, use of a short-acting sulfonylurea (such as glipizide) is considered an appropriate alternative option. If monotherapy alone does not achieve/maintain an HbA1c target over 3 months, the next recommended step would be to add a second agent to metformin. Recommended secondary agents include sulfonylureas, TZDs, DPP-4 inhibitors, GLP-1 receptor agonists or basal insulin. In the elderly, treatment must be individualized based upon patient tolerability as well as existing comorbidities; the motto “start low and go slow” is often recommended when initiating any new medications in an elderly patient to avoid unwanted adverse effects.

Sulfonylurea use

Sulfonylureas are the oldest class of oral hypoglycemic agents available on the market today, and some of the most widely used. Specifically second generation sulfonylureas are a low cost option for many patients, with several generic alternatives available. Current options include glyburide, glipizide, and glimepiride, and are often identified on retail pharmacy discount drug programs. Sulfonylureas are considered “insulin secretagogues” because their mechanism of action is to stimulate pancreatic beta cells to secrete insulin; however, pharmacokinetic properties vary amongst the second generation drug class. Overall, sulfonylureas are well-tolerated, but their side effect profile is dependent upon drug metabolism, excretion, and half-life. They primarily lower postprandial blood glucose, but have also shown to affect fasting blood glucose as well. Sulfonylureas are noted for lowering blood glucose concentrations by 20%, as well as HbA1c levels by 1 to 2%.

Pharmacokinetics

Each sulfonylurea has a unique pharmacokinetic profile. The absorption between each agent varies, with glyburide displaying the fastest onset of action. Glyburide is also metabolized hepatically into active metabolites that are 50% renally excreted, while glipizide is metabolized hepatically into inactive metabolites that are 90% renally excreted and glimepiride into active metabolites that are 60% renally excreted. Please view Table A for complete pharmacokinetic and dosing information.

Hypoglycemia

The most pronounced adverse effect of sulfonylureas is hypoglycemia. Hypoglycemia, defined as a plasma glucose levels < 70 mg/dL, is a notable side effect of these medications and must be taken into account in glycemic management in type 2 diabetes. Older patients, especially the frail elderly, are at an increased risk for hypoglycemic events, as it is primarily related to sulfonylurea pharmacokinetics, especially with declining renal function. Symptoms of hypoglycemia include: tachycardia, sweating, palpitations, tremor, headache, confusion, visual disturbances, seizures or coma. Unfortunately, these symptoms are not always accurately reported by the elderly patient to their physician; they may also be misinterpreted as a primary neurological disease (i.e. transient ischemic attack), or completely missed altogether.

The degree to which each sulfonylurea causes hypoglycemia differs between agents, due to the variability in the pharmacokinetic profiles. Glipizide has a shorter half-life when compared to glimepiride and

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**Table 1. Pharmacokinetics and Dosing of Second Generation Sulfonylureas**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Glyburide</th>
<th>Glipizide</th>
<th>Glimepiride</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Absorption</strong></td>
<td>Onset of Action: 15-60 mins, Time to Peak: 2-4 hrs</td>
<td>Onset of Action: 1.5 hrs, delayed w/ food, Time to Peak: 1-3 hrs</td>
<td>Onset of Action: 2-3 hrs, Time to Peak: 2-3 hrs</td>
</tr>
<tr>
<td><strong>Metabolism</strong></td>
<td>Hepatic: Active metabolites</td>
<td>Hepatic: Inactive metabolites</td>
<td>Hepatic: Active metabolites</td>
</tr>
<tr>
<td><strong>Excretion</strong></td>
<td>50% renal, 50% biliary</td>
<td>90% renal, 10% biliary</td>
<td>60% renal, 40% biliary</td>
</tr>
<tr>
<td><strong>Elimination Half Life</strong></td>
<td>10-24 hrs</td>
<td>2-5 hrs</td>
<td>5-9 hrs</td>
</tr>
<tr>
<td><strong>Usual daily dose, mg</strong></td>
<td>2.5 to 10</td>
<td>IR: 2.5 to 10, XL: 5 to 10</td>
<td>2 to 4</td>
</tr>
<tr>
<td><strong>Dosing per day</strong></td>
<td>Once</td>
<td>Once or divided</td>
<td>Once</td>
</tr>
</tbody>
</table>
glyburide, with glyburide boasting the longest half-life. It has been reported that glyburide’s extended half-life of more than 24 hours is due to the formation of active metabolites that could accumulate within the body. Glyburide is also believed to bind to the pancreatic sulfonylurea receptor for a longer duration than other sulfonylureas. This long half-life and longer duration of binding allows for greater suppression of overnight hepatic glucose output, therefore lowering fasting blood glucose concentrations. In addition, glyburide is not recommended in patients with a creatinine clearance of < 50 mL/min, due to 50% of the taken dose being eliminated unchanged in the urine. As a result of changes in metabolism and excretion that occur with aging, glyburide can accumulate in patients with renal dysfunction, and has been associated with a 2-fold incidence of hypoglycemia in elderly patients when compared with glipizide.

**Use of Glyburide in the Elderly**

Per CMS and the AGS, glyburide has been graded as a one of two sulfonylureas to avoid due to the high risk of severe prolonged hypoglycemia, and is on the list of HRMs to avoid in the elderly. As mentioned previously, glyburide has a prolonged half-life in older adults, with the risk further increased in those with impaired renal function. In a meta-analysis conducted by Gangji and colleagues, it was found that glyburide caused more hypoglycemia overall when assessing hypoglycemia variances between the different available sulfonylureas. Users of glyburide had a 52% greater risk of experiencing at least one episode of hypoglycemia compared to those receiving other insulin secretagogues (alternative sulfonylureas or meglitinides). Moreover, when evaluating all sulfonylureas, glyburide use was associated with an 83% higher risk of experiencing a hypoglycemic episode.

A retrospective study of about 14,000 Medicare enrollees looked to compare the risk of developing serious hypoglycemia in patients ≥ 65 years of age who were prescribed one of six sulfonylureas from 1985 to 1989. The study concluded that among all included sulfonylureas, hypoglycemia was noted highest amongst glyburide users and lowest amongst tolbutamide users. An increased risk for experiencing a serious hypoglycemic episode was associated with glyburide use in all strata, including those defined by gender, race, nursing home residence, dose and duration of use, in contrast to glipizide. Furthermore, hypoglycemia occurred twice as often in those taking glyburide when compared to those taking glipizide. Between all sulfonylureas, patients prescribed chlorpropamide and glyburide were noted to have the highest rates of hypoglycemia.

A cohort study conducted in the United Kingdom assessing the risk of hypoglycemia in patients treated with a sulfonylurea also found similar results as these previously mentioned studies. The risk of hypoglycemia was found to be higher in those using glibenclamide (also known as glyburide) than any other type of sulfonylurea. The research team also found that duration of therapy, concomitant use of insulin, and use of beta-blocker were positive predictors for developing hypoglycemia. In a more recent study by Skoff and colleagues, HbA1c levels were evaluated as well as the prevalence of hypoglycemia during treatment with glyburide or glipizide in veterans converted from glyburide to glipizide. The incidence of hypoglycemia, as demonstrated in previous studies, occurred more frequently with glyburide treatment. Specifically, hypoglycemia occurred in 31.2% of patients during glyburide treatment and 12.8% of patients during glipizide treatment, which proved to be significant.

Possible alternatives to glyburide therapy include glimepiride or glipizide, though glipizide may be considered the primary choice due to its shorter half-life and inactive metabolites. It is important to continue to assess the risk versus benefits when treating elderly type 2 diabetic patients with sulfonylureas. Table 2 provides the recommended conversion from glyburide to glipizide and glimepiride.

### Table 2. Conversion from glyburide to glimepiride or glipizide

<table>
<thead>
<tr>
<th>Drug</th>
<th>Comparative daily dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glyburide</td>
<td>1.25 mg QD</td>
</tr>
<tr>
<td></td>
<td>2.5 mg to 5 mg QD or divided BID</td>
</tr>
<tr>
<td></td>
<td>5 mg QD or divided BID</td>
</tr>
<tr>
<td></td>
<td>10 mg QD or divided BID</td>
</tr>
<tr>
<td></td>
<td>20 mg QD or divided BID</td>
</tr>
<tr>
<td>Glimepiride</td>
<td></td>
</tr>
<tr>
<td>Glipizide</td>
<td></td>
</tr>
</tbody>
</table>
Drug Comparative daily dose

<table>
<thead>
<tr>
<th>Drug</th>
<th>Glyburide, micronized</th>
<th>Glimepiride</th>
<th>Glipizide</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75 mg</td>
<td>1.5 mg to 3 mg</td>
<td>1 mg</td>
<td>2.5 mg</td>
</tr>
<tr>
<td>QD</td>
<td>QD to divided BID</td>
<td>1 mg to</td>
<td>5 mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 mg QD</td>
<td>QD or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to divided</td>
<td>divided</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BID</td>
<td>BID</td>
</tr>
<tr>
<td>3 mg</td>
<td>2 mg QD</td>
<td>5 mg</td>
<td>5 mg</td>
</tr>
<tr>
<td>QD or divided</td>
<td></td>
<td>QD or</td>
<td>QD or</td>
</tr>
<tr>
<td>BID</td>
<td></td>
<td>divided BID</td>
<td>divided BID</td>
</tr>
<tr>
<td>6 mg</td>
<td>4 mg QD</td>
<td>10 mg QD</td>
<td></td>
</tr>
<tr>
<td>QD or divided</td>
<td></td>
<td>or divided BID</td>
<td></td>
</tr>
<tr>
<td>BID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 mg</td>
<td>8 mg QD</td>
<td>20 mg</td>
<td></td>
</tr>
<tr>
<td>QD or divided</td>
<td></td>
<td>to 40 mg</td>
<td></td>
</tr>
<tr>
<td>BID</td>
<td></td>
<td>divided BID</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

As the prevalence of diabetes continues to grow annually in the U.S., especially amongst those aged 65 years or older, it is important to recognize that prevention, in addition to appropriate therapeutic intervention, are key to reducing the complications associated with this debilitating disease. Careful consideration should be used when selecting medications in the geriatric population, especially because the progression of diabetes can contribute to renal dysfunction. The use of glyburide in the elderly will remain a concern until provider prescribing behavior is modified. Many studies have shown glyburide to pose a significant risk to the elderly population due to the increased incidence of causing hypoglycemia. Safer alternatives, including glipizide and glimepiride, should be considered prior to the utilization or initiation of glyburide.

References

What was your first job?
I had my first working experience during the summer between my junior and senior years at high school. Einstein’s Bagel Bros was my introduction to the working world. Nothing quite teaches you to appreciate school more than having to get up a 2 AM to bake bagels.

What is your favorite travel destination and why?
Though I’ve haven’t traveled there, yet, my favorite place would have to be Japan. I’ve always been fascinated by Japanese culture and would love to experience it in person!

If you could have dinner with one living or non-living person, who would it be and why?
I think it would be incredible to speak with William Shakespeare. He lived such an interesting life and getting to know someone with such an incredibly creative mind would be an experience to cherish.

What is something most people don’t know about you?
I was in the marching band in high school (colorguard, the flag core) and seriously considered a professional drum core career.

What is your favorite movie of all time?
That’s a tough one...I’m a sucker for old English romance so I’d have to say Pride & Prejudice. Though I can’t ever seem to get past Shakespeare in Love if I find it either. :) 

What is the quality you most admire in others?
Why?
Acceptance. I think the world would be a safer more unified culture if people could learn to accept the differences between us with grace and love.

What is the one thing you need every day?
A hug from my son.

What was the first concert event you ever went to?
Janet Jackson, the Rhythm Nation tour. It was incredible and an experience I’ll never forget. Especially seeing my Dad sing and dance along to “What have you done for me lately.”

What’s your guilty pleasure?
Anything pastry...Yum.

Why do you do the job you do?
I actually fell into this industry and got hooked. I enjoy the variety of tasks and that I never know what the day will bring.