Improving Medication Safety

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EDUCATIONAL OBJECTIVES
After the completion of this activity pharmacists will be able to:

• Identify and define medication safety terms used in pharmacy practice

• Describe the medication use process and where errors occur in this process

• Discuss how to implement risk reduction strategies for each of the ten elements of the medication use system

• List causative factors of medication errors in community pharmacy

• Outline the recommendations for preventing medication errors

• Identify medication safety challenges in the pediatric population

• List factors that increase the potential for medication errors in elderly populations

  a. Describe the Beer’s Criteria and polypharmacy as it relates to the elderly population

INTRODUCTION
Medication errors and discrepancies are on the rise, and pharmacists and pharmacy technicians are a vital part in the medication-use process since pharmacists dispense the medications and are one of the most available healthcare professionals in the community. According to the CDC, from 2007 to 2010, almost one-half of all Americans reported taking one or more prescription drugs in the past 30 days with 9 out of 10 persons aged 65 and over taking at least one prescription drug.5

Preventing, identifying, and resolving medication errors and discrepancies are powerful tools to guarantee the patient’s safety. This document discusses why medication errors occur and how pharmacists and pharmacy staff can reduce the frequency of medication errors to ensure patient safety.

MEDICATION SAFETY TERMS
Before discussing how to prevent medication errors and discrepancies, it is vital to understand and define medication safety terms used in pharmacy practice. Main terms that will be used throughout this document include the following: medication error, medication discrepancy, adverse drug event, and drug interaction.

Medication Error: The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) defines a medication error as:

“any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing, order communication, product labeling, packaging, nomenclature, compounding, dispensing, administration, education, monitoring, and use.”

Although this definition is complex, the Food and Drug Administration’s (FDA) Division of Medication Error Prevention and Analysis utilizes this definition to review medication reports on marketed prescription and non-prescription drugs.3

Medication Discrepancy: A medication discrepancy can be defined as unexplained differences among documented regimens across different sites of care.4 Medication discrepancies are a major cause of harm to patients and are prevalent. Many patients visit multiple physicians and have prescriptions filled at different pharmacies, which can lead to medication discrepancies. Transitional care involves a broad range of services and environments to help patients move from one healthcare setting to another. If high-quality transitional care is not offered it can lead to increased medication discrepancies and medication errors.7 In hospitalized patients, 67% have at least one error in their prescription medication history at the time of admission. Older adults are specifically at an increased risk for medication discrepancies during transitional care because of multiple chronic disease states that lead to complex therapeutic regimens.

Adverse Drug Event: An adverse drug event, also known as an ADE, is defined as any injury resulting in intervention related to a drug.4 An ADE can occur in any healthcare setting and remains a potential major harm to patients taking medications. In inpatient settings like a hospital, one-third of all events reported consist of adverse drug reactions that prolong the length of the hospital stay by three days. In the outpatient setting, ADEs are estimated to cause over 3.5 million physician office visits and one million emergency department visits.

Another definition of an ADE derived by the American Society of Health Systems Pharmacy (ASHP) states that a significant ADE is any unexpected, unintended, undesired, or excessive response to a drug that must meet any one specific criteria outlined in Table 1.7 The ASHP also states that it is the pharmacist’s responsibility and obligation to report any ADE by following the policies and procedures established at the individual’s workplace.

Lastly, it is important to note that not all adverse drug events are caused by medication errors. Approximately 28% of ADEs are associated with medication errors and can be prevented, but some ADEs cannot be prevented and may be due to a side effect of the drug or hypersensitivity to the particular medication that cannot be avoided.4

Certain medications have been identified as having a higher risk of causing an ADE if administered improperly. These are considered high-risk medications. The Institute for Safe Medication Practices (ISMP) publishes lists of high-alert medications (including high-risk medications as well as look-alike/sound-alike drugs) for ambulatory care and for acute care settings.9 These lists are available in printable form on ISMP’s website and are a good resource for high-risk medications. In the ambulatory care setting, examples of high-risk medications include: insulin, warfarin and...
components of one’s diet, or with chemicals used in diagnostic procedures with themselves, with chemicals located in the body, with opioids. In the hospital setting, the anticoagulant heparin is one of the highest-risk medications.

Drug Interaction: A drug interaction is the pharmacological result of two or more drugs simultaneously exerting their actions with themselves, with chemicals located in the body, with components of one’s diet, or with chemicals used in diagnostic procedures. Drug interactions can be either desirable or undesirable based on the effect the interaction has on the patient.

Since the definitions of medication error and discrepancy have been covered in detail, the reasons why medication errors occur can be discussed, as well as how pharmacy technicians and pharmacists can play a role in preventing and/or decreasing errors to provide the best care for patients.

MEDICATION USE PROCESS

Dispensing medications is a multi-step process, which includes five steps defined by the United States Pharmacopeia. These steps include: prescribing, transcribing/documenting, dispensing, administration, and monitoring. To learn how to decrease the number of medication errors, pharmacists and pharmacy technicians must look at the medication-use process to determine where most errors occur. Unfortunately, the precise frequencies of dispensing errors are not known. One difficulty in reporting errors is the fear of disciplinary action against the person who committed the error. Reporting of errors is important and should be encouraged and should be blame-free. The Institute of Safe Medication Practices (ISMP) allows consumers and healthcare practitioners a safe and confidential site to report medication errors. The reports are forwarded to the FDA. Reporting errors is voluntary; however, through systems like this one the healthcare industry can begin to understand where the breakdown of the medication-use process is located.

Of the errors reported, prescribing errors account for 39% of all medication errors during the medication-use process. These errors are made due to lack of knowledge about the prescribed drug, lack of an established relationship with the patient, distractions that cause slips in judgment, or calculation errors. Transcription and verification make up 12% of errors and are due to illegible handwritten prescriptions, use of abbreviations that are misinterpreted, and the use of misleading or trailing zeros. During the dispensing stage of the medication-use process, calculation errors, preparation errors, and distribution errors account for 11% of the mistakes made. The patient could be dispensed the wrong drug, wrong dose, wrong formulation, or an incorrect label with inaccurate instructions. Lastly, 38% of errors occur during administration of medications. Similar packaging, failing to double check, failing to understand what the drug does, unclear medication orders, and understaffing are listed as the top reasons for medication errors during the administration of drugs.

Errors caused by drug administration can be made by a healthcare professional or by the patient. The error rate during drug administration is partially due to lack of communication regarding the drug name, drug appearance, why the patient is prescribed a drug, how and when to administer the drug, common side effects, and common drug interactions. The patient and the pharmacy staff must take an active role in communicating important information regarding medications.

In conclusion, the medication-use process is a step-by-step system that allows patients to receive the medication that has been prescribed. Errors can easily occur while dispensing and administering a medication due to the number of steps in this process. Most errors result in the prescribing phase of the medication-use process with the second-most resulting during administration. By examining the medication-use process, we can better understand how to prevent medication errors and discrepancies in the future.

KEY ELEMENTS OF THE MEDICATION USE SYSTEM

The ISMP has developed ten key elements of the Medication Use System, which are discussed in detail below. Each of the ten elements is important to ensure the safe use of medications. Errors occur when there is a failure at any one of these points. Pharmacies should be proactive and implement risk-reduction strategies to prevent an error from occurring.

Patient information: The first key element is patient information. Errors can occur when there is a lack of patient information. In fact, the ISMP reports that up to 18% of serious, preventable ADEs occur due to providers not having enough information about a patient before prescribing, dispensing or administering a medication. An example of a patient information error is a patient receiving a prescription for a medication to which he or she is allergic. Risk-reduction strategies can be implemented at each stage of the medication filling process to prevent patient information errors. For instance, during the drop-off stage it is important to ask for or verify patient allergy information at each visit. At drop-off, it is also important to ask for two patient identifiers and to make sure that each patient has only one profile in the system. The patient’s date of birth should be noted on every prescription. An additional piece of information that should be obtained for pediatric prescriptions is the patient’s weight. The pick-up stage is also an important point where risk-reduction strategies can be implemented to prevent patient information errors. It is important to do the following: confirm the patient’s allergies and ask for two patient identifiers.

<table>
<thead>
<tr>
<th>Table 1. ASHP Adverse Drug Event Criteria</th>
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<tr>
<td>1. Requires discontinuing the drug (therapeutic or diagnostic)</td>
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<td>2. Requires changing the drug therapy</td>
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<td>3. Requires modifying the dose (except for minor dose adjustments)</td>
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<td>4. Necessitates admission to a hospital</td>
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<td>5. Prolongs the stay in a healthcare facility</td>
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<td>6. Necessitates supportive treatment</td>
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<td>7. Significantly complicates diagnosis</td>
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<td>8. Negatively affects prognosis</td>
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<tr>
<td>9. Results in temporary or permanent harm, disability, or death</td>
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Drug Information: There are many types of drug information errors. An example of a drug information error in the pharmacy is a technician selecting the wrong dose of a medication during the order-entry stage. Other types of drug information errors include miscalculation of a dose or use of inappropriate units. Risk-reduction strategies include having up-to-date resources available in the pharmacy and providing education to all staff about new drugs that will be stocked in the pharmacy.

Communication of drug orders and other drug information: Communication errors can occur in the pharmacy due to illegible handwriting, use of dangerous abbreviations, or misplaced decimals to name a few examples. Standardization is the best way to reduce the chance of communication errors. Risk-reduction strategies recommended by ISMP include: reading back prescriptions to the caller, spelling back sound alike drug names and calling prescribers if a prescription is illegible. Pharmacy staff should never develop their own abbreviation for a drug name or prescription directions. Only approved abbreviations should be used.

Drug labeling, packaging and nomenclature: Failure to correctly choose a drug is one of the most common errors in medication dispensing. Often, misidentification occurs when the packaging of one medication is similar to the packaging of another medication. These are considered “look-alike” drugs. Another potential cause is inappropriate labeling. Errors are especially likely to occur when look-alike drugs are stored close together and even more likely when the space is overcrowded. For this reason, all storage areas for drugs (shelves, cabinets, refrigerator shelves) should be large enough to permit storage without clutter and should contain dividers or bins to separate medications. Often pharmacy staff can recognize medications by the look of the container (color, shape, size) or the location on the shelf. This familiarity can lead to errors if the person thinks they see what they are expecting to see, rather than what is actually there. Risk reduction strategies for errors related to drug labeling, packaging and nomenclature include: listing the indication for the medication directly on the prescription label and adding “attention-getting” labels on the shelves where look-alike or sound-alike medications are stored.

Drug standardization, storage and distribution: A “simple, consistent alphabetical system” is recommended for stocking of medications to reduce the risk of errors. Errors can occur, as mentioned above, if there is not enough space to store new stock. When stocking medications, it is safest to have a designated space to unpack and check-in the delivery. Regular checking for short-dated medications is also essential, and out-of-date, recalled, and to-be-returned products should be kept in areas away from the regular inventory. Risk reduction strategies related to the storage and distribution of drugs include: stocking ophthalmic products in a separate location from otic products, separating insulin types into different storage containers in the refrigerator, never leaving a medication unlabeled and returning medications to stock when they have not been picked up for 7 days. Another important storage consideration: food and drink should never be kept in the same refrigerator with medications.

Medication device acquisition, use and monitoring: Many medications must be administered using drug delivery devices. Errors can occur when patients are not well-informed about how to use these devices. Also, equipment within the pharmacy must be kept clean and used correctly. Risk-reduction strategies include: completing regular maintenance and calibration of all equipment, cleaning pill-counting trays after dispensing certain medications (eg. penicillin, sulfonamides, opiates, NSAIDs, chemotherapy agents). Proper hand-washing is essential prior to compounding any medication (such as oral liquids, ointments, etc.). Measuring devices used in compounding must also be clean.

Environmental factors, workflow and staffing patterns: Distractions and poor working conditions can contribute to medication-use errors. Risk-reduction strategies include keeping workstations neat and free from clutter and separating patient orders from each other by bins. Other factors such as poor lighting, frequent interruptions, excessive noise and staff working while they are sick have contributed to medication-use errors.

Staff competency and education: Staff education is important for reducing errors; however, education alone is not enough. Education must be combined with other risk reduction strategies described above. Staff education should include formal training in the classroom or online as well as educating all staff when an error does occur.

Patient education: Patients are the last chance in the medication use process to prevent an error. Patients should be encouraged to be involved in their own care and informed about their medications. Some important risk-reduction strategies for patient information include: affixing appropriate auxiliary labels to medication vials, updating patient profiles to contain a list of all their medications and including a proper measuring device when dispensing liquid medications. Caregivers should also be counseled regarding the use of devices to measure liquid medications.

Quality processes and risk management: Reported medication errors can be used to identify areas for improvement within an organization; therefore, reporting of errors should be encouraged and blame-free. Internal error reporting is essential for companies to revise procedures and prevent future errors. Similarly, voluntary adverse event reporting to the ISMP, FDA and the manufacturer are important if labeling corrections are needed. In the past, changes in drug names that were similar and confusing have resulted from adverse event reporting. Important risk-reduction strategies include promoting error reporting and implementing quality control measures.

MEDICATION ERRORS IN COMMUNITY PHARMACY

In the United States, more than 3 billion medications are prescribed each year. Varying observational case studies in outpatient community pharmacies have reported error rates ranging from 0.2% to 10%. If using an error rate of 1%, this can be extrapolated to project that a total of 30 million errors would occur each year in the United States. Community pharmacies play a huge role in preventing medication errors. Currently, no standard exists for prescription dispensing errors in community pharmacies, but an error rate exceeding 5% can result in withholding of...
reimbursement by the federal Centers for Medicare and Medicaid Services in nursing home settings.

According to an article in the US Pharmacist, errors in community pharmacies can be categorized by a causation viewpoint that includes a mechanical or judgmental error. A mechanical error can be made in the preparation/processing of a prescription. Looking at the medication-use process, the steps of transcribing/documenting and dispensing would be the most likely place a mechanical error would occur. A judgmental error is defined as an omission of information or error associated with patient counseling, drug therapy/patient screening, or monitoring. The steps of the medication-use process that fit this type of error include prescribing, administration, and monitoring. Mechanical errors can include transcribing the wrong instructions for administration or choosing the wrong drug, while an example of a judgmental error could be not properly counseling a patient on how to use a dropper to measure the dose for a child.

Since explaining the type of errors that can occur in community pharmacy, let us discuss the reasons why errors may occur. A survey was conducted by the Massachusetts Board of Registration in Pharmacy to determine pharmacists’ views on the impact of various factors and the relationship on incidence of medication errors. The factors that pharmacists believe contribute to medication errors are located in Table 2, which was adapted from the Medication Error Study (1999).17

In the community setting, some factors that relate to medication errors unfortunately cannot be changed. For example, telephone calls and busy days are always going to play a role in the community setting. As pharmacists and pharmacy technicians, it is our responsibility to ensure patient safety when dispensing medications and try not to become distracted from the factors listed above. No time to counsel is an important factor listed that can be changed. Since more patients are taking multiple medications, counseling is imperative to prevent medication errors through understanding of what the medication is used for once the medication leaves the pharmacy. Many organizations offer recommendations to aid in preventing medication errors, which will be discussed in the next section.

RECOMMENDATIONS FOR PREVENTING MEDICATION ERRORS

NCC MERP

The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) is one of multiple organizations that publish recommendations to reduce medication errors. The first set of recommendations focus on medication errors associated with at-risk behaviors by healthcare professionals.18 NCC MERP defines at-risk behaviors as actions in which healthcare practitioners sometimes engage that may harm patients. Healthcare professionals often engage in at-risk behaviors when the task at hand becomes comfortable or repetitive. The most common at risk behaviors found by the NCC MERP are listed in Table 3. Understanding these behaviors allows for change and correction to reduce the use of at-risk behaviors. The specific recommendations from NCC MERP to enhance the accuracy of dispensing medications are discussed on the next page in Table 4.19

American Society of Health Systems Pharmacy

ASHP produced a statement with steps to promote a solution to the problem of medication errors. This statement provided a summary of recommendations on the reporting of medication errors to learn how to improve the health care delivery process based on the types of errors that are being reported (2000).20 ASHP lists three steps they believe are key to helping solve the national problem of medication errors.

1. The establishment of a standardized, uniform nationwide system of mandatory reporting of adverse medical events that cause death or serious harm.
2. Continued development and strengthening of systems for voluntary reporting of medical errors. 
3. Strengthening efforts to implement process changes that reduce the risk of future errors and improve patient care.

Reporting medical errors is vital to learn how to continue to improve healthcare. Reporting of these errors needs to become culturally acceptable, and the reporter should not fear blame or punishment. The first of the three key steps is a standardized mandatory reporting system. ASHP called for a mandatory
reporting system, but noted several characteristics that the system must include, which are reported in Table 5.

Both ASHP and NCC MERP recognize the importance of reducing medication errors. NCC MERP focuses on the working environment and the best practices of pharmacists and pharmacy staff to reduce errors, while ASHP identifies a solution to the lack of reporting of medication errors and the need for a mandatory reporting system. While most pharmacies implement these recommendations, continued review of the medication-use process is imperative to the continued improvement of medication use and safety.

MEDICATION SAFETY IN SPECIAL POPULATIONS

Pediatrics

In pediatric patients, the number of potential adverse drug events is three times more than that found in hospitalized adult patients making this special population a high-risk group for medication errors.20 Important factors put this population at risk more than adults, because pediatrics has different and changing physical characteristics between patients at various ages and stages of development. Also, dosing a pediatric patient often requires calculations based on the patient’s age, weight, and height, and, during administration, caregivers and healthcare providers must use precise dose measurements and appropriate drug delivery systems. Lastly, lack of FDA-approved labeling regarding dosing, safety, efficacy, and clinical use makes prescribing for pediatrics difficult.

The ISMP along with the Pediatric Pharmacy Advocacy Group (PPAG) published specific recommendations for pharmacy to help decrease medication errors in the pediatric population. Pharmacists should interact with other members of the healthcare team to ensure the best care for the patient and pay close attention to reviewing prescriptions and preparing and dispensing medications while serving as the drug information specialist. Most importantly, it is the pharmacist’s job to ensure that the patient and caregiver receive the proper counseling on how to administer medications before being discharged. The ISMP and PPAG specifically recommend the patient or caregiver has the appropriate equipment for the correct measurement and administration and is able to demonstrate how to prepare and administer the dose. When dealing with this population either in a hospital or community setting, extra care and time are required to ensure the safety of medications being prescribed.

Geriatrics

There are several factors that complicate treatment in the elderly and make medication errors and ADEs more likely. Often, elderly patients have multiple medical conditions and take more medications as they age.21 According to a 2007 study, almost 35% of 85 to 89 year olds took at least 10 medications compared with around 14% of 60 to 64 year olds.22 As the number of medications a patient takes increases, the risk of adverse effects also increases. The CDC reports that patients aged 65 or older are twice as likely to have an ADE requiring treatment at the emergency department (ED) and 7 times more likely to require hospitalization.23 Certain characteristics of elderly patients also make them more likely to experience ADEs. For example, physiologic changes that occur with age can make elderly patients more sensitive to some medications. To address the potential problems with certain medications in the elderly, a guideline known as the Beer’s Criteria was developed. The Beer’s Criteria identifies potentially inappropriate medications (PIM) that are not recommended for elderly patients due their ability to cause poor outcomes in this population.

Changes in the elderly: Changes in older patients generally include decreased metabolism by the liver and decreased kidney function.24 A person’s ability to clear certain drugs that undergo metabolism by the liver may be decreased by as much as 30 to 40%, and decreased doses are often needed. Medications that commonly require smaller doses in elderly patients due to decreased metabolism include certain pain medications, cardiovascular drugs and psychoactive drugs.

Decreasing kidney function is another important change that occurs as a patient ages. Reduced kidney function decreases the body’s ability to eliminate many drugs. Therefore, lower doses may be required. Drugs that may require adjustments for kidney function include certain antibiotics, pain medications and diuretics.

Polypharmacy: Polypharmacy is defined as “taking more medications than clinically indicated.”25 Polypharmacy is common in the elderly, with 55 to 60% of patients who are 65 years old or older taking at least one medication without an indication.26 The risk factors for polypharmacy are listed in Table 6. Polypharmacy in the elderly has several consequences including increased risk of future errors. As the number of medications increases, the risk of future errors also increases. Polypharmacy is thought to decrease medication adherence as well. Evidence also indicates that polypharmacy causes a decline in activities of daily living and increased mortality.

Beers Criteria: The Beer’s Criteria is a guideline of potentially inappropriate medications (PIMs) for elderly patients who are at least 65 years old. This includes drug classes that should be avoided in the general population of older patients as well as medications that should be avoided in patients with specific comorbid conditions. For example, alprazolam is not recommended for the treatment of insomnia in elderly patients since they have greater sensitivity to the drug. In general, all drugs of this class (benzodiazepines) have the potential to cause cognitive impairment, delirium, fractures, falls and motor vehicle accidents in the elderly.

CONCLUSION

Improving medication safety involves understanding how and when medication errors are most likely to occur and implementing strategies to reduce the risk of future errors. As the incidence of medication errors decreases, patients will benefit from fewer ADEs and prevention of unnecessary emergency room visits and hospitalizations. The NCC MERP, ASHP and ISMP have all published recommendations related to the safe use of medications and are valuable resources for information about error prevention. Prevention of medication errors in pediatric and geriatric populations deserves special attention since these patients have a higher risk for experiencing ADEs. Overall, risk-reduction strategies should be closely followed to reduce the chance of avoidable medication errors.
Table 4. NCC MERP Recommendations for Enhancing Accuracy of Dispensing Medications

1. Prescription orders should always be reviewed by a pharmacist prior to dispensing.
2. Patient profiles need to be current and contain adequate information that allows the pharmacist to assess the appropriateness of a prescription/order.
3. Dispensing area must be properly designed to prevent errors.
   a. Adequate lighting, air conditioning, minimize distractions, and provide adequate staffing and other resources for workload
4. Product inventory should be arranged to help differentiate medications from one another.
5. The use of bar coding systems, computer systems, and patient profiles is recommended to establish a series of checks to establish the accuracy of the dispensed product before the medication is given to the patient.
6. Labels be read at least three times
7. Pharmacy staff triple check replenishment of regular medication stock or automated dispensing machines/cabinets
8. Pharmacists counsel patients at the time of dispensing and should cover: indications, precautions/warnings, expected outcomes, potential adverse reaction and drug interactions, actions to take if an adverse reaction occurs, and storage requirements.
9. Pharmacies collect and analyze data regarding actual and potential errors for the purpose of quality improvement.
10. Both initial and continuing training of all pharmacy staff with the objective of reducing medication errors.
11. Each pharmacy establish policies and procedures for the medication dispensing process to ensure all pharmacy staff are informed of expectations related to the dispensing process.

Table 5. Characteristics of the Mandatory Reporting System

1. An overall focus on improving the processes used in healthcare, with the proper application of technical expertise to analyze and learn from reports.
2. Legal protection of confidentiality of patients, healthcare workers, and in the information submitted to the extent feasible while preserving the interest of the public accountability.
3. Nonpunitive in the sense that the submission of a report does not engender a penalty on the reporting institution, the practitioner, or the others involved in the incident.
4. A definition of “serious harm” that concentrates on long-term or irreversible patient harm, so as not to overburden the reporting system.
5. National coordination and strong federal efforts to ensure compliance with standardized methods of reporting, analysis, and follow up, that emphasize process improvement and avoid culture of blame.
6. Adequate resources devoted to report analysis, timely dissemination of advisories based on report analysis, and development of appropriate quality improvement efforts.
7. Periodic assessment of the system to ensure that it is meeting intent and not having serious undesired consequences.

Table 6. Risk factors for Polypharmacy

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<tr>
<th>Demographic</th>
<th>Health Status</th>
<th>Access to Healthcare</th>
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<tbody>
<tr>
<td>Increased age</td>
<td>Poorer health</td>
<td>• More healthcare visits</td>
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<tr>
<td>White race</td>
<td>Depression</td>
<td>• Supplemental insurance</td>
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<td>Low education level</td>
<td>Certain heart problems</td>
<td>• Multiple providers</td>
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<td>Taking 9 or more medications</td>
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REFERENCES


