We are IntechOpen, the world’s leading publisher of Open Access books
Built by scientists, for scientists

3,900
Open access books available

116,000
International authors and editors

120M
Downloads

154
Countries delivered to

TOP 1%
Our authors are among the most cited scientists

12.2%
Contributors from top 500 universities

WEB OF SCIENCE™
Selection of our books indexed in the Book Citation Index in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com
Chapter 4

Dangers of Polypharmacy

Pamela L. Valenza, Thomas C. McGinley, James Feldman, Pritiben Patel, Kristine Cornejo, Najmus Liang, Roopa Anmolsingh and Noble McNaughton

Abstract

Although the definition of polypharmacy has evolved over time, it has been and remains to be an issue in healthcare. With the prevalence of polypharmacy increasing, those in the health care field must remain vigilant of the adverse effects of medications and work to coordinate care and maintain appropriate prescribing practices. Here we present a clinical vignette that describes an encounter of a patient on multiple medications and the individual, provider, and systems-level issues that may have contributed to an adverse event resulting in a hospital stay. We will discuss the definition of polypharmacy, review the prevalence and economic implications of drug prescription practices, and examine the consequences and complications of polypharmacy in a number of different patient populations. We will discuss a number of scenarios involving polypharmacy that lead to medication errors, decreased quality of life, and patient harm, and then review evidence-based methods of interventions aimed at reducing the prevalence of polypharmacy and its associated complications.

Keywords: polypharmacy, risk factors, root causes, complications, interventions

1. Introduction

Although the definition of polypharmacy has evolved over time, it has been and remains to be an issue in healthcare. With the prevalence of polypharmacy increasing, those in the health care field must remain vigilant of the adverse effects of medications and work to coordinate care and maintain appropriate prescribing practices. Here we present a clinical vignette that describes an encounter of a patient on multiple medications and the individual,
provider, and systems-level issues that may have contributed to an adverse event resulting in a hospital stay. We will discuss the definition of polypharmacy, review the prevalence and economic implications of drug prescription practices, and examine the consequences and complications of polypharmacy in a number of different patient populations. We will discuss a number of scenarios involving polypharmacy that lead to medication errors, decreased quality of life, and patient harm, and then review evidence-based methods of interventions aimed at reducing the prevalence of polypharmacy and its associated complications.

2. Patient vignette

An 89-year old male presents to his primary care provider for follow-up after a recent hospitalization for a non-displaced hip fracture after a fall at home. He has poorly controlled hypertension, gastroesophageal reflux disease, hyperlipidemia, depression, prediabetes, arthritis, cataracts, and a remote history of heart disease with stents placed years ago. He reports two new medications were started in the hospital but he does not know why they were prescribed. The hospital did not fax over any records and the patient did not bring his discharge information summary to his appointment. At this time, he does not report any side effects of the new medicines but he would like to discuss getting treatment for ongoing fatigue, insomnia, and worsening joint pain. He reports seeing his cardiologist a couple months ago, who changed the dose of one of his blood pressure medicines but the patient is not sure which medicine was changed or the milligrams of the new dose. When asked to fill out a release of information to send to the cardiologist, the patient replies his cardiologist retired not long after his last appointment and the patient needs a referral to see a new cardiologist. In addition to a cardiologist, the patient also follows with a gastroenterologist, psychologist, psychiatrist, and ophthalmologist. None of the providers utilize the same electronic medical record system. On review of the list of medications the primary care provider has on file, the patient only recognizes eight out of sixteen medicines. In addition, his primary care provider personally prescribes only six of the medications on the list. When asked about compliance, the patient is adamant he always takes his medications as prescribed, but states his wife, who is currently at home, helps him take his medicines because he has some difficulty reading the labels and remembering to take them at the appropriate times.

3. Defining polypharmacy

Polypharmacy first appeared in the medical literature more than a century and a half ago [1]. Polypharmacy has multiple meanings without a clear consensus in the scientific community of a strict definition. This is most apparent in the wide range of research into the subject and how such data can be applied differently to various definitions of the term [2]. Defining polypharmacy can be further complicated by patients taking over-the-counter...
medications and vitamins that are often not reported and as clinicians, it is not improbable to be treating patients with multiple conditions requiring multiple medications for optimal control. However, most clinicians would agree that polypharmacy is defined as the concomitant use of five to nine medications and hyperpolypharmacy, or excessive polypharmacy, is defined as the use of ten or more medications [3–5].

4. Drug prescription practices

Across all persons aged 20 or older, the prevalence of polypharmacy increased from an estimated 8.2% in 1999–2000 to 15% in 2011–2012 [6]. If the use of non-prescription medications is included, the prevalence of polypharmacy in the adult population increases to 29% [7]. The National Center for Health Statistics estimated that in 2014, approximately 2.8 billion prescription medications were ordered in the ambulatory office setting, of which the most frequently prescribed medications were analgesics, antihypertensives, and antidepressants [8]. Meanwhile, in the hospital outpatient departments, 329.2 million medications were prescribed with the most commonly ordered agents being analgesics, antidiabetics and antihyperlipidemics [8]. Overall, prescription drug use increased in many of the most common drug classes used by Americans including antihypertensives, antihyperlipidemics, antidepressants, antidiabetic agents, prescription analgesics, prescription proton-pump inhibitors, anticonvulsants, bronchodilators, and muscle relaxants [6]. Outpatient pediatric (aged ≤18) polypharmacy is also substantial with a prevalence rate of 10%, occurring more often in the setting of a complex chronic condition [9].

Individuals greater than 65 years old are the biggest consumers of medications; however, evidence shows that greater than 50% of elderly patients are taking at least one medication that is not medically necessary [10]. Nearly 40% of elderly adults take more than five prescription medications and almost 20% take more than 10 [6, 11]. Additionally, approximately half of the elderly population takes at least one over-the-counter drug and approximately half of the elderly population takes at least one nutritional supplement in combination with prescription medications [6, 11]. Polypharmacy declines in patients older than 85 years of age secondary to poor drug tolerance with age and increasing deprescribing practices as medical providers fear serious adverse drug reactions that may be more common in the very elderly [12].

5. Economic implications

In 2014, the United States (US) was estimated to have spent $3 trillion on total national health care expenditures, of which 9.8% ($294 million) was spent on prescription drugs [8]. Approximately, $77.7 billion was spent on total expenditures on Medicare Part D program in 2014, and an estimated $165.1 billion will be utilized by 2022 [13]. This number will continue to increase as the estimated number of Americans >65 years of age by 2050 is projected to be 88.5 million, more than double that of 2010 (40.2 million) [14]. The US Center for Medicare and
Medicaid Services (CMS) states that polypharmacy has been estimated to cost US health plans over $50 billion annually [8, 15, 16]. With respect to medication discrepancies and patient adherence, if patients took all appropriate medications exactly as prescribed, it is estimated it would save 13% ($290 billion) of total US health care expenditures due to avoidable medical costs [17].

An estimated $16.4 billion and $4.2 billion are spent on inpatient and outpatient preventable medication errors, respectively [18]. Adverse drug events (ADEs) occur commonly in hospital settings, which in turn increase the likelihood of morbidity, length of stay (LOS), and the cost of care. A multicenter retrospective cohort study conducted in six community hospitals significantly showed that ADEs are associated with an increased adjusted average hospitalization cost of $6910 and increased length of stay of 5 days [19]. The severity of ADEs are associated with further increased costs and length of stay ($9768 in patients and LOS 7.79 days with significant ADEs versus $15,033 in patients and LOS 10.56 days with life-threatening ADEs) [19]. Research evaluating the effect of computerized provider order entry (CPOE) in the outpatient setting has shown the potential to result in fewer medication errors and ADEs by 1.5 million and 14,500, respectively, with the potential to save $18 million dollars [20]. In the hospital setting, the implementation of CPOE is associated with an estimated 50% reduction of ADEs and medication errors [21].

6. Root causes of polypharmacy

The prevalence of polypharmacy is multifactorial with risk factors spanning from the individual/patient level (increasing longevity, coexistence of chronic medical conditions, availability of over-the-counter drugs, use of more than one pharmacy) to the physician level (medical guidelines, prescribing practices) to systems-level issues (multiple prescribing providers, electronic medical records, transitions of care) [22]. See Figure 1 for a comprehensive list of the factors associated with polypharmacy [23, 24]. Medical practitioners rely on clinical guidelines to guide their medical practice and clinical decisions to provide the best care to patients. Available clinical guidelines are usually devised with focus on a single disease and often overlook the possibility of comorbidities and the consumption of other medications by the patient [1]. Adherence to clinical guidelines for multiple concomitant chronic conditions may inadvertently lead to adverse outcomes for patients due to complications from multiple medications for multiple medical conditions [25]. In the post-acute transition of care setting, patients can often see their medication list expand or see changes in dosages due to their recent debilitation and hospitalization [3]. There are often multiple clinicians, sometimes in the form of multidisciplinary teams, making medical decisions. Lack of communication between treatment teams and disruption in communication during transitions of care from the inpatient setting to the outpatient setting and vice-versa can precipitate polypharmacy [23]. If we look at our patient in the clinical vignette, there exists several risk factors for polypharmacy: elderly age, multiple chronic conditions, decreased ability to function, multiple providers, poor physician-patient communication, poor physician-physician communication, multiple prescribers, and disjointed electronic medical records.
7. Polypharmacy complications and consequences

The more drugs an individual takes, the more likely he or she will suffer a complication or adverse outcome [4]. Polypharmacy is associated with increases in many adverse outcomes including adverse drug reactions, drug to drug interactions, drug to disease interactions, non-adherence, falls, cognitive impairment, hospital admission and mortality [4, 12, 26].

Adverse drug reactions (ADRs) are defined as undesired or noxious effects of standard drug treatment doses which include amplified drug effects, side effects, interactions with other drugs and interactions with other nutrients or diseases [11]. ADRs are a common cause of hospital admissions and emergency department visits [27, 28]. Many factors contribute to adverse drug reactions including unnecessary drug use, inappropriate drug choice, therapeutically duplication, inappropriate dosing regimen, physician-patient communication, and long-term medication use without periodic review [26, 29].

In the hospital setting, polypharmacy is a strong predictor of adverse drug reactions in both adults and pediatrics [30]. Not only are hospitalized adults at risk of adverse events from potentially inappropriate medications or drug-drug interactions, patients with polypharmacy are at higher risk due to medication discrepancies that may result from unintended discrepancies in actual regimen versus recorded regimen during transitions from outpatient to inpatient and vice-versa, changes to medication regimens while in the hospital, and poor
communication of medication changes to both patient and next provider of care [31]. Large numbers of hospitalized pediatric patients are exposed to polypharmacy with increased risk associated with longer lengths of stay and presence of complex chronic conditions [32, 33]. Polypharmacy increases potential drug–drug interactions in pediatrics, often due to off-label prescribing of drugs, lack of therapeutic profiles for less common medications, and weight-based medication errors [34].

Medical record discrepancies in the outpatient setting occur in about 75% of cases, with a strong positive correlation with polypharmacy, with rates escalating as high as 95% [17]. Discrepancies may include active prescriptions that the patient did not include on their medication record or patient-reported medications that were not documented in the electronic health record. Adverse events due to medical record discrepancy occur not only from failure to perform reconciliation, but failure to ensure and promote patient adherence to the regimen as intended by the provider [17].

Medication errors cause at least one death every day and injure 1.3 million people annually in the United States [35]. Several factors contribute to medication errors secondary to polypharmacy. Errors can easily occur when patients are seeing multiple specialty providers for comorbid conditions. Nearly 40% of all medication errors and 50% of adverse drug events are a result from errors in prescribing such as overdosing of medications, underdosing of medications, allergies, improper dose, improper drug, and duplication of therapy [36]. Lack of communication and coordination between treating providers increases the likelihood of prescribing medications which may result in adverse drug reactions, side effects or worse. Failing to review patient records and reconcile medications at regular visits by all providers poses greater risk for the occurrence of errors [37]. Omission of performing adequate medication reconciliation, including asking about over-the-counter medications, herbas, vitamins, and nutritional supplements, and patients’ failure to disclose other medication use may contribute to the occurrence of a preventable harmful drug–drug interaction [38]. To ensure accurate medication reconciliation, patients should be asked to bring all medications to each provider visit [39].

Transitions of care pose a danger of medication errors and include a change in setting, practitioner, type of service and move from one level of care to another [40]. Ineffective processes during transitions of care can result in adverse events and higher hospital readmission rates and costs [41]. During transitions of care, patient education regarding complicated regimens, lack of accountability of the clinical entity to provide coordination across settings, and lack of effective communication between providers are most often the root causes [42, 43].

Patient adherence to polypharmacy regimens presents another juncture at which errors may arise. Adherence is defined as the extent to which an individual’s behavior, including taking medicine, following a certain type of diet, or lifestyle modifications, corresponds with recommendations from a healthcare provider as agreed upon by the patient [44]. Nonadherence is defined as the improper intake of medication [44]. The complexity of a medicine regimen is inversely related to medication adherence with increasingly complex regimens (increased frequency of dose, decreased patient education) associated with lower rates of adherence [45]. Issues of adherence include patients who do not fill their prescriptions, decide to stop taking
medications, or fail to take one or more medications as prescribed [40]. These issues occur for a variety of reasons including financial hardship, symptom improvement, and unreported side effects.

Accidental inappropriate drug use may result from erroneous or repeat doses from poor eyesight or forgetfulness [46]. In addition, patients may not be able to accurately read and understand the labels on medications prescribed. With more than 33,000 trademarked medications, errors have commonly been linked to drugs with similar sounding names. Adding to the drug name confusion, are problems with similar packaging and labeling, incomplete knowledge, illegible handwriting, prescriptions which are orally communicated and a significant number of new products continually being introduced into the marketplace [47].

8. Special considerations in different patient populations

The following sections briefly touch on unique considerations when addressing polypharmacy in different patient populations and certain medical conditions.

8.1. Elderly/end of life

Older adults with comorbidities are often excluded from drug trials, therefore, the use of drugs in older populations to a large extent can be considered experimental [48]. The use of multiple clinical guidelines that do not account for multiple comorbid conditions, along with the knowledge of altered pharmacodynamics due to the physiological changes in older adults, can become dangerous to the elderly patient. Certain classes of drugs have been associated with cognitive impairment and falls, with elderly patients being more susceptible than others. Polypharmacy in elderly patients has been shown to be a predictor of frequent hospitalizations, nursing home placement, death, hypoglycemia, fracture, impaired mobility, pneumonia, and malnutrition [22]. As the elderly age, they are at increased risk of complications from polypharmacy including the inability to effectively metabolize and excrete multiple medications due to changes in liver and kidney function [22]. To confound this further, age-related change in pharmacodynamics resulting from changes in drug receptor affinity alters the concentrations of drugs that are effective and toxic [49]. Additionally, increasing use and number of medications seems to have a negative impact on nutrient intake and nutritional status overall in the elderly not only from drug-nutrient interactions, but also from compounded side effects such as nausea, decreased appetite, dry mouth and metallic taste which ultimately decrease food intake [46].

In elderly patients at the end of life, pain is a common symptom [50]. Patients undergoing palliative treatment are especially vulnerable to unwanted adverse effects of medications secondary to their altered metabolism, organ dysfunction, and high likelihood of polypharmacy with ensuing drug-drug and drug-host interactions [51]. In one study, potential drug-drug interactions (DDIs) were detected in 61% of inpatient hospice patients [52]. Polypharmacy was the major predictor for DDIs and the most commonly implicated drugs in therapeutically potential DDIs were antipsychotics, antiemetics, antidepressants, insulin, glucocorticoids,
cardiovascular drugs and NSAIDs [52]. In elderly patients, the remaining life expectancy of the patient should be considered when prescribing medication, as benefits of certain medications may not be valid or may not outweigh risks in a patient with a lower life expectancy. As patients age, it may be important to consider de-prescribing to optimize the patient’s total health and reduce unnecessary polypharmacy [48].

8.2. HIV population

With the evolution and advancement of antiretroviral therapies worldwide, HIV is now being considered a chronic disease. Life expectancy for HIV patients has been shown in recent years to closely approximate that of non-infected HIV persons [53]. The HIV population is also aging. Statistics show over 10% of HIV positive persons globally are over the age of 50, with projected data estimating this to increase by an additional 20% in the next 15 years [54]. In the United States alone, it is estimated that more than half of persons living with HIV are ≥50 years old [55]. In 2010, the prevalence of polypharmacy in persons living with HIV was estimated to be 35%, surpassing that of persons not living with HIV [55]. HIV patients have been noted to have greater cardiovascular, renal, neurologic, oncologic and osteoporotic disease despite having decreased viral loads or increased CD4 counts [56]. Presence of age-associated comorbidities increases the risk of polypharmacy in HIV patients, with higher rates of prescriptions for gastrointestinal, neurologic, respiratory, analgesic, or anti-infective drugs than the general population [57]. Antiretroviral therapy has a high risk for DDIs and toxicity, and optimizing management to address this risks and decrease pill burden can be difficult [54]. In older HIV patients, 77% are at risk of potential DDIs due to polypharmacy, with the highest risk in patients with concomitant cardiovascular drug use [58].

8.3. Kidney disease and liver disease

There is a high incidence of polypharmacy in patients with chronic kidney disease (CKD) [59]. Significant medication-related problems, including drug-drug interactions, high incidence of adverse drug reactions (ADRs) and low adherence have been noted [60]. Complex medication regimens may be necessary in CKD to treat related comorbid conditions, however patients are at high risk of DDIs, especially due to changes in pharmacokinetic and pharmacodynamic parameters associated with decreased kidney function, and therefore require constant adjustment of medication doses accordingly [61]. Complicated medication regimens and concerns about side effects were frequently cited as a cause of low or non-adherence in patients with CKD [62]. Additionally, use of certain contraindicated over-the-counter or herbal remedies may put the patient at increased risk of adverse drug events and interactions due to interference with CKD medications [63].

Liver pathology is of special importance especially when treatment of disease includes polypharmacy. Multiple drug regimens have shown to cause development of various forms of hepatotoxic reactions, and many patients with cirrhosis often have complicated medication regimens and are at higher risk for complications from polypharmacy [64]. Frequent reassessment of the patient’s baseline renal and hepatic function, medication properties, doses administered and length of therapy are helpful in achieving reduction in DDIs and ADRs [65].
Dangers of Polypharmacy

http://dx.doi.org/10.5772/intechopen.69169
Dangers of Polypharmacy

http://dx.doi.org/10.5772/intechopen.69169
Dangers of Polypharmacy
Dangers of Polypharmacy
http://dx.doi.org/10.5772/intechopen.69169
61
Others factors that may impact adherence include medication beliefs, increasing numbers of chronic diseases leading to complicated regimens, and sociodemographic factors such as high costs, co-payments, and lack of understanding [122, 124]. The utilization of cue-based interventions (i.e., phone reminders or alarms) may be helpful for forgetfulness but less likely to reduce non-adherence due to passive inconsistent behaviors [123, 125]. Health literacy interventions can improve patients’ education regarding their medications and therefore potentially improve the patients’ role in their management of medications. The importance of assessing patient literacy and readiness to be an active member of the health care team is the responsibility of the health care system. A health literacy pilot study found that 40% of patients had a low health literacy, which is defined as below 9th grade reading level [126]. After just 3 months of one patient literacy intervention, patients’ self-reported adherence had improved [126].

10. Conclusion

Polypharmacy is a multifactorial, complex issue. There are a number of targeted interventions that focus on addressing a variety of determinants with varying levels of evidentiary support. Optimizing prescribing, reducing potentially inappropriate medications, and minimizing risk is a common theme across all interventions, however implementation must be highly individualized for each patient.

Author details

Pamela L. Valenza*, Thomas C. McGinley, James Feldman, Pritiben Patel, Kristine Cornejo, Najmus Liang, Roopa Anmolsingh and Noble McNaughton

*Address all correspondence to: pamela.valenza@sluhn.org

Department of Family Medicine-Warren, St. Luke’s University Health Network, Phillipsburg, NJ, USA

References


[55] Moore HN, Mao L, Oramasionwu CU. Factors associated with polypharmacy and the prescription of multiple medications among persons living with HIV (PLWH) compared to non-PLWH. AIDS Care. 2015;27(12):1443-1448


