# Medication Reconciliation: An Ideal Process to Curb Adverse Drug Events

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## Abstract

Medication reconciliation is monitoring a patient's medication history and current medications. During medical reconciliation, errors may arise that pose a risk to patients and their safety. These errors include the patient not being able to recall all of the medications prescribed, recalling the wrong medications, and clinicians not being thorough enough in their evaluation of the patient's medication history. Adverse drug events may result due to medical reconciliation not being done correctly. To avoid errors in the medication reconciliation process, there must be a thorough evaluation of medication reconciliation, and the process must be compared with best practices. Analyzing the many steps in the process and recognizing where improvements can be made will allow patients to feel more comfortable with their medications and for the healthcare system to design a more appropriate protocol for completing the process.

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## Preface

I would like to acknowledge the University of Pittsburgh Graduate School of Public Health and the Department of Health Policy and Management and all who helped make this accomplishment possible. I would like to specifically acknowledge Prof. Laura Griffin and Prof. B. Guy Peters for their support and guidance throughout this project.

## 1.0 Introduction

Medication errors are shared through all phases of patient care in healthcare systems and represent a significant patient safety risk. Medication errors lead to Adverse Drug Events, otherwise known as ADEs, the most common type of error experienced in a healthcare facility. Such events represent a significant public health issue and have gained global attention as errors like contamination and negligence have subsided. Despite this attention, the current financial structure of the United States' healthcare system inhibits providers from fully embracing efforts to reduce medication errors.

Medication Reconciliation is the act of completing a medication history and correcting discrepancies between a patient's previous medication regimen and the proposed medication order [8]. When a patient is admitted to an inpatient facility, the standard operating procedure is thorough documentation of current medications, allergies, and prescription histories. However, outpatient facilities have more inaccuracies in their medication lists than inpatient facilities post discharge [16]. There is a large gap (33.9% vs 22.9%) that can be narrowed. Medication reconciliation characterizes a solution that can significantly reduce medication errors if performed correctly.

Through an analysis of an academic medical system's ambulatory facilities the effectiveness of a medication reconciliation process will be evaluated and compared to best practice literature. Interviews with patients and demographic data revealed barriers to a good medication reconciliation process and further emphasized points of implementation that will be useful for healthcare systems.

A well-known resource for this type of implementation is the Institute for Health Improvement's "How-to Guide: Prevent Adverse Drug Events by Implementing Medication

Reconciliation," but this has last been updated in 2011. Although this document has not been updated since 2011, this document still provides relevant information. However, it is vital to move an initiative like this into a new decade of healthcare using Electronic Health Records, and the interconnectedness interoperability allows. Where is the current healthcare system lacking in medication reconciliation, and how can the medication reconciliation process in outpatient facilities be altered to improve quality and efficacy and optimize performance?

## 2.0 Literature Review

### 2.1 Background of Adverse Drug Events and Medication Error

Adverse Drug Events cause approximately 1.3 million emergency room visits annually in the United States. These events, otherwise known as the acronym ADEs, “includes harm caused by the drug (adverse drug reactions and overdoses) and harm from the use of the drug (including dose reductions and discontinuations of drug therapy).” [9] These events come in all forms of severity and type, often changing the course of care for a patient significantly. Besides the financial loss, it adds to the massively inefficient healthcare system. Patients suffer from lengthy hospital stays and even experience loss of life due to these errors.

Drug withdrawal, drug misuse, drug interactions, and allergies are the most common ADEs, but not all events are the same. Some are preventable and can be alleviated with a keen focus on the prescription process in this country. Preventable ADEs can be broken down into prescription errors, patient errors, and reconciliation errors. Prescription errors are when patients have been prescribed the wrong medication for their ailments. Patient errors occur when patients do not obey the instructions of the medication, often misunderstanding instructions by taking too little or too many. Finally, patient error through reconciliation; this is when clinicians are not well informed of the drugs a patient has been taking prior to the point of care, leading to a complication that could be avoided if made clear.

A reconciliation error ADE is the most common. A comprehensive study of almost 4,000 patients found that 67% of patients experienced a prescription error, and the most common type of prescribing error was the omission of medication after reconciliation. [1] Another study found that

38.6% of their patients experienced medication discrepancies of clinical significance, meaning they had moderate discomfort or clinical deterioration, at the minimum, due to the reconciliation mistake and including severe discomfort or clinical deterioration. [3] These mistakes from hospital systems and providers have a significant effect on patient outcomes and must be addressed.

In another study conducted, over five thousand medication error cases were reviewed, revealing that 68.2% resulted in serious patient outcomes. Of the severe cases reported, 9.8% of medication errors caused the death of a patient. The most common type of fatal error was in patients over sixty years of age, showing a direct correlation between ADEs and age. According to CMS, the link between ADEs and age is due to several factors, notably that 68% of Medicare recipients have more than two chronic conditions [5]. When these chronic conditions compound, patients take more medication from many different sources, often leading to more adverse outcomes [17]. The study also reviewed only the cases submitted to the FDA, which is a significant underestimation of the number of medication errors across the country. [1]

Preventable ADEs are a huge saving opportunity for hospital systems [28]. A study conducted attributed the cost of preventable ADEs directly to a generic hospital system's bottom line. This analysis identified all self-reported incidents of ADEs that were severe to the point of hospitalization. The analysis created a risk-adjusted regression that directly correlated an increase in expenditure of $5,857 for each preventable ADE. When this is extrapolated to the size and scope of a 700-bed hospital within a medical system, the costs reach 2.8 million dollars directly tied to preventable ADEs.[2] This study only shows the quantifiable costs of ADEs to the hospital system and does not include the financial impact created by the stress it causes for staff, patients, and families.

## 2.2 Background of Medical Reconciliation

A medical reconciliation error is the most preventable of the three kinds of ADEs and will be the focus area of this section. Medical reconciliation is completing medication history, correcting discrepancies of a patient's previous medication regimen, and taking into account any allergies, new or old, which may affect a patient's medical interactions. A peer reviewed study showed that a series of interventions, including medication reconciliation, introduced over several months, successfully decreased the rate of medication errors by 70% and reduced adverse drug events by over 15% [3]. As nearly 20% of Medicare patients are readmitted within 30 days of discharge, minimizing post-discharge adverse events has become a priority for the US health care system [14]. The process begins at outpatient facilities because they are often the most frequent point of contact for patients. There are 267.1 outpatient visits per 100 individuals annually compared to 40.4 emergency room visits annually per 100 individuals. Ambulatory facilities are These medical offices are expected to be the first and most frequent faces patients see as they include annual checkups and continuous care as patients go about their lives.

The medical reconciliation process should occur before or during all visits to any healthcare facility, no matter what type of care a patient is seeking. This process often begins with a patient in an examination room accompanied by a nurse, PA, or medical assistant. The medical staff often ask a series of questions with varying levels of specificity about changes since the patient's last encounter. Because of varying levels of medical education, the depth in which patients and staff can recall this information may vary significantly. Often medical staff with a more rigorous background in healthcare can describe the medication's shape, size, and a possible reason for taking the medication, which can often elicit a patient to remember the medication and accurately inform staff of the status of said prescription. This information is usually placed into an EHR system that

needs to be approved by a provider (CRNPs, PAs, and physicians) to see the patient [14]. The EHR system works to highlight potential medication conflicts, mixing, or high dosage and will alert medical staff of these issues. Suppose the patient forgets and gives inaccurate information, or the staff mishears or ignores information and does not accurately capture the information received. In that case, medical reconciliation can lead to an ADE.

This process and the inclusion of EHRs are critical in the medical community's fight against ADEs. Electronic Health Records can track the care given, vitals, medication lists and automatically highlight areas of concern all by date and location. If done flawlessly, patients and medical offices will be on the same page about dos and don'ts to provide the patient with the best care. Through the connected nature of the internet, patients do not have to carry their healthcare data from visit to visit [19]. Clinical staff can often work around the medications currently taken by patients to create a unique plan that can still work with the medication history and avoid potential complications.

Medical reconciliation can also be a tool overall holistic care as the rise of value-based healthcare providers quickens. Programs that emphasize value-based care, like Medicare Accountable Care Organizations (ACO), are becoming more critically important to the bottom line of any healthcare system. The Centers for Medicare and Medicaid Services (CMS) give financial incentives to healthcare providers who score well on a variety of metrics they deem to be value-based. These incentives include high reimbursement rates and bonuses for top performers. The efficiency of medical reconciliation is asked twice on the CAHPS for Clinician and Group Survey [20]. The results from these responses can lead to better overall health. Clinicians at large health systems are often isolated in through their specialty or focus group and do not look at every facet

of patient care according to studies done on fragmented care [18]. ACOs look to communicate and work together to bring better health outcomes to their members [15].

The most critical component of medical reconciliation that is often overlooked is communicating an updated medication list to all other providers that the patient is seeing or may see [2]. Interoperability is the ability of two or more systems to exchange health information and use the information once it is received. Interoperability ensures that a patient arrives at a medical facility with an updated, accurate, and understood medical history. This process makes a huge difference in patient outcomes and completes a holistic aspect of care.

### 2.3 Problems with Medical Reconciliation

There are many issues with current medical reconciliation practices and processes that will be evaluated further in this section. The first issue is the lack of standardization in the process. Depending on the medical facility, even within the same health system, the process may be varied by site. There is not a consensus on ownership of the procedure [17]. For example, some offices have the process done and completed entirely by front desk staff with limited knowledge of the patient or their history. Even when the physician is in charge of the process, they are bogged down by the time and resources it takes to update the list and does not give the same rigor and care to the procedure lower-level staff may give [4].

The questions asked during the medication reconciliation process can also be standardized. With a prompt or checklist, clinical staff will compare equivalent information for each patient for every facility. For example, one facility may only ask what prescriptions the patient is currently taking, while another may distinguish what the patient is currently taking, what they have been

prescribed, and when they stopped taking the medication prescribed, including their reasoning. Bridging this gap so that patients can respond consistently will ensure that each facility is getting the same information. This second layer of questioning adds significant depth to the process. The staff recording this information can understand if patients have a potential allergic reaction to a drug, understand what other points in the patient's condition are trying to be addressed, and receive clarity into how recently these treatments have been diverted.

Physicians or other clinical staff may be unfamiliar with the prescriptions on the medication list. Fragmented care is common with patients seeing many different physicians for different ailments [18]. This disjointed process is a huge issue, especially for frequently seen specialists, because their practice may be the only facility the patient sees for months before a potential emergency room visit. If the patient's charts have not been updated in a year or more, medical diagnoses can be incorrect due to the lack of information. This compounds the chances for ADEs and leads to a plethora of financial and health issues for both the individual and the health institution.

A massive flaw in medication reconciliation is that it relies on patients to recall information. Patients can follow their prescriptions perfectly, and at a doctor's visit, misremember or mispronounce the name of a drug leading to confusion and complications. Relying on non-medical professionals for their most critical medical information is a huge barrier to this system. Without a position to communicate the importance and veracity of this medical information before a visit, many patients neglect to inform their providers [15]. The lack of information in this instance will be detrimental to further diagnoses and plans of action. With limited information, mishaps are more likely occur with severe adverse drug events being an increasingly possible outcome.

Barriers to communication between entities frequently causes ADEs. The lack of interoperability, or simply detail-oriented note-taking, causes many issues in the reconciliation space. In an EHR system, there is often a lack of note-taking that can add important information and alleviate the risks of ADEs. Even when notes are taken thoroughly, there may be a miscommunication between EHR systems that leads to these issues not being be displayed clearly [NIST]. Bridging this gap of communication will lead to the best outcomes for patients.

### 2.4 Medical Reconciliation Best Practices

Several entities have conducted studies that have found the best practices for medication reconciliation. The Institute for Healthcare Improvement has set six steps to correct medical reconciliation in ambulatory facilities. These six stages consist of:

1.Identify the steps in the reconciliation process

2.Identify responsibilities for the process

3.Use a standardized form or list

4.Create an explicit time frame for completion

5.Design education forums for healthcare professionals

6.Communicate new list to appropriate stakeholders consistently [6]

These requirements eliminate gaps that can be formed in inpatient care. The six steps outlined here will create a new environment for medication reconciliation and allow the process to be streamlined. Even the most fervent supporter of this initiative could see that it may be unrealistic to have nationwide process adoption.

There is another list of best practices for medical reconciliation made by the Agency for Healthcare Research and Quality. Instead of steps to complete a process, the AHRQ focused on five main guidelines that healthcare entities should focus on. The first two in this list is develop a single interoperable list that can be easily shared between providers and standardize the reconciliation process. This saves time, money and focuses on consistency between providers. If all practitioners were making changes to one list and each practice at the same questions there would be very little variability in medical documents completed by different facilities. The third and fourth guidelines is to clearly define roles at a facility and give prompt to staff members for their roles. This means outlining each step in the process and giving authority over that role to a single staff member. This will limit inconsistency as well while giving each employee a purpose in the process while reducing confusion over control. Finally, AHRQ noted a more holistic approach to the process. Their last point is to ensure patients, family and/or caregivers were educated about the medication on each list. Highlighting the importance of education is unique and very important. The patient should have resources and support from those around themselves to have an open dialogue about their medical history and future. Involving family members helps align all members of the patient's "care team" to a common goal.

The American Academy of Orthopedic Surgeons (AAOS) analyzed medical reconciliation and found that employing pharmacists to be responsible for all portions of this process and asking a set of guided questions to input into EHRs is the most efficient process. Pharmacists are highly trained in drug classification and drug interaction. They can offer their expertise to ensure that medications are accurately prescribed to avoid adverse drug events while also conversing with patients about specific medications in great detail ("Information Statement" 1-9). The pharmacists would be tasked with meeting every patient and would conduct the entire medical reconciliation

process. Although employing full-time pharmacists is usually too high of a barrier for most outpatient facilities, it clarifies that highly trained medical professionals are needed to complete this integral healthcare function.

## 3.0 Case Study

Medical reconciliation is unique to each region, state and facility. The most highly regarded hospital systems are known to have established trade secrets to optimize their processes and lead to better health outcomes. Other hospitals systems have the infrastructure and the resources to dedicate individuals to specialize in and optimize their processes to hopefully reach a point of efficiency. To find this level of efficiency, the process of medical reconciliation must be thoroughly analyzed and trends must be sought before any conclusions.

### 3.1 Large Hospital System

There are many hospital systems in Western Pennsylvania. One in particular has a robust group of ambulatory facilities. They have analyzed and done research into the medical reconciliation process of these outpatient practices looking for trends and best practices. These facilities can be broken down into three groups: primary care offices, including geriatric facilities, surgical specialty, which includes facilities like orthopedic and neurosurgical, and non-surgical specialty, which includes practices like ENT, endocrinology and dermatology.

### 3.2 Collection Methods

The goal of this initiative was to come back with best practices that can apply to the medication reconciliation process for each type of practice. CAHPS scores were used to determine

which facilities were slated for visitation. C&GS CAHPS is a care survey given to patients at random post-visit to give hospitals and outpatient facilities a national, standardized, publicly-reported survey of patients' perspectives [CAHPS]. The low and high scoring practices were aggregated by two questions. These questions were:

13. In the last 6 months, how often did this provider seem to know the important information about your medical history?

20. In the last 6 months, how often did you and someone from this provider's office talk about all the prescription medicines you were taking?

The two questions essentially asked patients did the healthcare provider conduct the medical reconciliation process to a point where you are aware that it occurred. Data was collected and analyzed for each practice, and the best and worst HCAHPS scoring practices were highlighted. Each facility group's best five and worst five practices were scheduled for a random visit and analysis of 5-10 outpatient visits. This data was collected by entering numerous practices and observing various patient visits. The visit was to watch all nurses, MAs, and physicians present during the shadowing period. The medical reconciliation process focused on observation, determining how each practice structured the process and how the patients felt toward the process. Patients were verbally asked how their medication history had been transferred to the current system, if the information stored by the practice was up-to-date information and if the information was consistent and available among other facilities.

The observer filled out a post-observation reflection form after observing the visit. This reflection form consisted of questions that aimed to depict the amount of information that the practice was gathering regarding the given patient's medical history and gather a better

understanding of what the medication reconciliation process looks like at the given practice. For example, some of the questions on the reflection form were: Did the medical assistant review and confirm drug allergies? Did the medical assistant confirm the name, dosage, and frequency of medication(s) prescribed? Did the medical assistant review over-the-counter medications and herbal supplements?

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## 3.3 Results

**Table 1**

| Practice Type | | Average Age | Asked all Questions | Additional Questions | Physician Follow-up |
|---|---|---|---|---|---|
| Primary Care | High Scoring | 48 | 94% | 85% | 60% |
| | Low Scoring | 72 | 37% | 23% | 19% |
| Non-Surgical Specialty | High Scoring | 50 | 67% | 75% | 52% |
| | Low Scoring | 53 | 30% | 4% | 0% |
| Surgical Specialty | High Scoring | 48 | 60% | 78% | 57% |
| | Low Scoring | 52 | 30% | 7% | 12% |
| Total | High Scoring | 49 | 85% | 82% | 58% |

| | | | | | |
|---|---|---|---|---|---|
| | Low Scoring | 59 | 35% | 10% | 13% |

The facilitator of the program initially gathered all data and anecdotally noted trends and reported to their supervisor. Following the data collection process, all data was inputted into a Microsoft Excel spreadsheet to be further analyzed. It was found that at primary care facilities with a high HCAHPS score, 94% of mandatory medical reconciliation questions were asked to all patients. Primary care facilities with a low HCAHPS score, only asked 37% of the mandatory medical reconciliation questions. Surgical specialty offices with high HCAHPS scores asked 67% of all mandatory questions. Surgical specialty facilities with low HCAHPS scores asked the mandatory questions 30% of the time. Finally, non-surgical specialty facilities with high HCAHPS score asked the set of required questions to patients 60% of the time and the same type of facilities with low scores asked the mandatory questions 30% of the time. This shows a stark difference

There was a significant age discrepancy between high and low HCAHPS scores in the primary care sector. The average age at each high scoring facility was 52 and the average age for low scoring offices was 74. The average age for each specialty facility group was within the margin of error. 83% patient interactions with physicians or providers at high HCAHPS scoring facilities asked additional questions pertaining to medical reconciliation. 10% of low scoring facilities had providers ask additional questions. 58% of high scoring facilities had physicians that verbally confirmed to patients that they reviewed medical reconciliation lists for, whilst 13% of low scoring facilities had physicians that reported the same.

### 3.4 Analysis

There were very differences in the high and low scoring groups. There were significant barriers for the low scoring groups of primary care facilities. Three of the 5 facilities visited were geriatric specific or serving predominantly Medicare aged patients. Many patients in these age groups did not care completely for themselves or were brought to the physician through an assisted living facility. Some of these patients had little to no recollection of medications they had been taking or only knew them by their shapes and sizes. The combination of these barriers made it difficult for the medical staff to successfully complete the medical reconciliation.

Primary care offices devote more time to the medical reconciliation process according to the observation of the observer. Based on the report from the facilitator of the program, the medication reconciliation process of primary care facilities assigned multiple staff members to review and report the reconciliation information. The facilitator of the program found that there was as much emphasis on this procedure besides surgical visits in a pre-operation appointment. In these instances, medical reconciliation was done as thoroughly as the high scoring primary care practices seemingly to limit adverse effects of a surgery.

The physicians of each high scoring facility had an especially important role by reemphasizing that the reconciliation had been done and asking questions about the charting done to confirm that it was correct. This type of buy in was rarely seen at the low scoring practices. There were barriers to certain facilities asking questions to patients it was on average the high scoring facilities followed up on the medical reconciliation.

Non-surgical specialty facilities, even the high scoring ones did not adhere to companywide policy in regards to medical reconciliation. Although, many of the procedures and care given to patients at these facilities are minimally invasive, there is still a duty to update medical charts and

reconciliation as often as possible. The best scoring medical reconciliation practices from the non-surgical group acted very similarly to low scoring primary care facilities in regards to asking all the medical reconciliation questions required by the facility.

There were several best practices observed that could not be noted in the data. One of the best and worst scoring primary care facilities discussed the process of prior to the appointment automating reminder calls, mentioning that patients should bring a list or physically bring in all medication they are currently prescribed and/or taking. This process made a significant difference in the efficiency of the medication list. One of the practices was low scoring, so once they reviewed the pill bottles brought in, they ceased discussing medical reconciliation with the often-elderly patients or their care giver. This is still an area of opportunity for this practice because the high scoring practice, with the same idea to pre-verify medications are accounted for before the visit, still asked patients about their list and verbally confirmed the veracity of each prescription.

## 3.5 Discussion

The findings of this case study in conjunction with evidence-based practices can create environments conducive to best practices in the medical reconciliation space. Demographic data is very important. There is a clear distinction in efficiency of "med rec" in analyzed populations of Medicare age. For these groups, as emphasized in several studies, care should be a collective assignment [10]. Leaning on a partner, a caregiver, a child of the patient or employees at a nursing home will allow for the best possible outcomes. Communicating with the patient about who in their network is informed about their medical condition can alleviate a lot of the medical reconciliation burden from the elderly patient. This can include education and visuals showing

reference size and shape of particular medication to see if it is a drug previously mentioned in their healthcare information.

Reviewing medication lists prior to an appointment is another key finding that can be applied in many other outpatient facilities. With the rise of mobile healthcare applications, healthcare systems should invest in adding alerts for medication reconciliation prior to outpatient visits. This simple step should remind patients to make sure all their medications are up to date and this alert will mentally connect an appointment with prescription verification [15]. Although this would involve significant reliance on patients, much like the current processes in place, the extra step of reminding patients has been shown to decrease mistakes and furthermore ADEs.

Finally in the small sample size of the case study, the observer found a very strong correlation between physicians involving themselves in the medical reconciliation process and high CAHPS scores. This step is as simple as acknowledging that they've seen the patients charts and reconfirming the information. It seems there is a relationship between a physician acknowledge things to the patient and patients remembering the interaction. This may be due to the fact that physicians are usually the final members of clinical staff or that physicians have more healthcare specific training but this can be used to ensure that the process is complete and concerns are acknowledged.

There may be issues with in-person evaluations especially with an unknown member of administration conducting a study. The first potential problem is the Hawthorne effect. This is a known phenomenon in psychology, when "individuals modify an aspect of their behavior in response to their awareness of being observed" [22]. Practice managers at each facility were contacted before the observer went to each location and sometimes were warned that medical reconciliation was the process that was to be observed. This ruins the study if low and high scoring

practices improve their reconciliation process specifically to please the observer. Interestingly there was still a large statistical difference in high and low scoring practices in almost all parameters but even the slightest effect may have changed the outcome of this study. The study can be repeated with undercover patients or a recording device that is allowed to be used in a facility.

Specifically choosing the most extreme cases of data may also be an issue. Regression towards the mean in statistics is thew concept that concept that refers to “the fact that if one sample of a random variable is extreme, the next sampling of the same random variable is likely to be closer to its mean” [23]. In the case study’s situation, there were intentionally selected the "most extreme" events and there might not be an actual statistical difference between these two groups and that follow-ups must be done to confirm this. This will lead to false conclusions being jumped to. In the case of this study, the data and observations show a significant difference between each group but that may not always be the case. Next time an experiment like this is conducted with random ambulatory healthcare facilities visited, and then the data collected will be used to show if there is a correlation between the initial scores and the data retrieved at each practice.

## 3.6 Conclusions

There are many different ways to reduce adverse drug events but revamping the medical reconciliation process is one of the most cost-effective ways [21]. The steps needed to emphasize the lifesaving methods of the process are available to be learned from. The US healthcare sector can address the challenges of fragmented care and changes in insurance reimbursement with a consistent and interconnected message to all ambulatory healthcare providers. Adverse Drug

events can continue to fall with a push from providers to work together to achieve the most interoperable care possible. With physician documentation, EHRs, and telemedicine, becoming more interoperable by the year, it sees hopeful that issues. The leading and governing bodies of healthcare at CMS, IHI and AHRQ show that medical reconciliation has scalability and potential for significant improvement. The questions still loom as to what the biggest and most influential healthcare provider groups in this country will do to improve this critical process.

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