Title: A Journey of Challenges with Medication Reconciliation

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ABSTRACT

Background and purpose: Unintentional medication errors are a significant problem in terms of morbidity, mortality and cost. Medication reconciliation is one of several strategies to reduce medication errors. The purpose of this study was to examine accuracy of electronic medication reconciliation upon admission compared to discharge.

Method: A retrospective electronic chart review was conducted at a tertiary care safety-net hospital using a data extraction tool created for the study. Modifiable and non-modifiable factors related to medication reconciliation were analyzed using descriptive statistics.

Conclusions: The sample of 150 patients (mean age 58.8, SD 9.4) had more males and was predominately white. Results suggest prevalence of medication discrepancies were detected, corrected and significant in greater than 60% of discharge medication reconciliations. Eighty percent of patients were discharged home with a change in medication regime. Seventy-one percent patients reported to be on five medications or more. The most common comorbid illnesses included hypertension (86%), hyperlipidemia (67%), and coronary artery disease (60%).

Implications: Discharge Medication Reconciliation is costly in terms of nursing workload. Detected discharge medication reconciliation took 30 minutes or less to get discrepancies corrected. Delay in discharge to correct medication discrepancies may have a negative impact on patient satisfaction and financial management of the institution. Outcomes rely on health care provider's ability to enter complete and accurate medication information in the medical record and to identify risk factors for medication discrepancies.

Background

Healthcare encompasses a vast area of clinical practice where unintentional medication errors might occur. Hence, care must be taken to ensure patient safety. Unintentional medication errors are a significant problem in healthcare in terms of morbidity, mortality and cost. At least 1.5 million Americans are injured every year by medication errors (IOM, 2006). On average, every hospital patient is likely subjected to at least one medication error per day, leading to approximately 98,000 annual deaths. Furthermore, the cost of medication errors is high in terms of negative patient outcomes and litigation. Over 3 billion dollars are spent annually towards treating the consequences of medication errors. Clearly, effective strategies to mitigate medication errors are needed. (Karapinar-Carkit et al., 2009). Conducting a detailed medication history with open-ended questions, proper and accurate documentation of medication reconciliation and electronic technology compliance can prevent these errors.

The current process of medication reconciliation emphasizes evaluating and improving the medication regimen throughout the hospital continuum to reduce patient harm. To diminish medication errors and improve quality of care, medication reconciliation has been developed (Karapinar-Carkit et al., 2009). The process includes a comprehensive list all prescription medications, herbal supplements, vitamins, nutritional supplements, over-the-counter drugs, vaccines, diagnostic and contrast agents, radioactive medications, parenteral nutrition, blood derivatives, and intravenous solution. The purpose of this study is to identify the accuracy of electronic medication reconciliation upon admission compared to discharge.

Review of Literature

Medication reconciliation plays a vital role to optimize safe medication administration upon admission and discharge. To avoid medication errors (e.g. omissions, duplications, dosing errors, or drug interactions) as well as to observe compliance and adherence patterns, health care providers need to know the correct and comprehensive definition of medication reconciliation. Medication reconciliation is an integral part of care transitions in which health care providers collaborate to improve medication safety as patient's transition between levels of care. Improving accuracy of medication reconciliation is one strategy used by hospital systems to prevent errors. The primary purpose of medication reconciliation is to correct discrepancies that may occur in the medication regimen across the healthcare continuum thereby improving quality, effectiveness and safety. In addition, medication reconciliation will most likely promote cost effectiveness (Karapinar-Carkit et al., 2012).

Improper medication reconciliation and unintentional medication errors lead to adverse effects, inaccurate dosing, and decreased patient satisfaction. Several studies examined medication reconciliation outcomes on admission to discharge (Salanitro et al., 2012; Pippins et al., 2008). Salanitro and colleagues found an 18%-42% medication discrepancy rate in medication histories, admission orders and discharge orders. Most of the discrepancies (42%) were with medication histories (Salanitro et al., 2012). Gleason and colleagues supported this and found more than half of the patients they studied had discrepancies in medication histories and admission orders (Gleason et al., 2010; Unroe et al., 2010). Similarly, Vira and colleagues found a 38% discrepancy rate in their study of newly admitted patients (Vira, Colquhoun, & Etchells, 2006). Omission of a medication a patient was taking prior to admission was among the most common discrepancy found. Unintentional medication discrepancies often are due to

improperly conducting a medication history (Pippins et al., 2008). These errors in preadmission and discharge medication histories are common in the elderly and patients with polypharmacy (Salanitro et al., 2012). In the midst of these discrepancies and errors, patient safety is a challenge. The proper way to conduct medication reconciliation is to collect accurate and detailed history with open-ended questions.

Historically, medication reconciliation was done using paper documentation. Presently, electronic documentation is emerging as a promising strategy for preventing medication errors. Evidence based studies demonstrate that well-defined medication reconciliation processes and the implementation of electronic medication reconciliation has reduced the rate of medication errors (Pippins et al., 2008; Poon et al., 2006; Schnipper et al., 2009). However, a risk of potential patient harm remains due to the fact that electronic medication reconciliation process will function appropriately as long as the data entered was accurate and if the system recognizes each medication accurately in its proper form. The aforementioned studies suggest implementation of bar-coded technology were the hallmarks to reduce medication errors.

Several studies reported implementation of bar coded medication administration technology considerably reduced medication errors at least by half. Most of the studies conclude that use of bar coded medication administration technology reduced medication errors by 50%-to 63%, thereby improving patient safety and cost effectiveness (Kerr, Heelon, & Higgins, 2010; Paoletti et al., 2007; Poon et al., 2010; Wang, 2011). Poon and colleagues observed 14,041 medication administrations and reviewed 3082 order transcriptions, a 41.4% relative reduction in errors ($P<0.001$) with bar coded technology. This provided increased accuracy and led to implementation of electronic medication reconciliation. The electronic health record is generally believed to contain more accurate information and allow faster retrieval of information compared

to paper based records. Data supporting the hypotheses that implementation of electronic medication reconciliation reduces medication errors also found data are only as accurate as what has been entered. Several studies suggest that implementation of a standardized medication reconciliation process reduced the number unintended medication discrepancies, potential medication errors and patient harm (Pippins et al., 2008; Poon et al., 2006; Sinvani et al., 2013; Turchin, Gandhi, Coley, Shubina, & Broverman, 2007; Ziaeian, Araujo, Van Ness, & Horwitz, 2012). Appropriate system technology and technical support is needed at all times to ensure proper electronic medication reconciliation. Several investigators suggest electronic medication reconciliation to reduce medication discrepancies (Pippins et al., 2008; Poon et al., 2006) but few authors studied medication discrepancies on admission to discharge using electronic medication reconciliation.

Recent studies demonstrated that the pharmacist's involvement in medication reconciliation during transition of care resulted in improved patient outcome, patient safety, patient compliance and an overall reduction in health care costs. One indicated that 36% of the patients had medication errors on admission, of which more than 75% originated from the medication history (Allende Bandres, Arenere Mendoza, Gutierrez Nicolas, Calleja Hernandez, & Ruiz La Iglesia, 2013). An additional study from a large academic medical center suggests medication reconciliation reduced discharge medication errors from 90% to 47% on a surgical unit and from 57% to 33% on a medical unit. Findings thus far support pharmacists enhanced medication reconciliation improved patient compliance and demonstrated reduction in hospital stay, readmissions and overall health care costs (Allende Bandres, Arenere Mendoza, Gutierrez Nicolas, Calleja Hernandez, & Ruiz La Iglesia, 2013; Gleason et al., 2010; Karapinar-Carkit et al., 2012; Murphy, Oxencis, Klauck, Meyer, & Zimmerman, 2009; Wong, 2011).

Medication reconciliation is a major component of providing safe patient care in any environment. There is evidence to demonstrate how the medication reconciliation process is effective at preventing medication errors. When nurses identified discrepancies, physicians changed the discharge orders of 94% of patients (Barnsteiner, 2005). Few studies focus on how to do the process effectively with electronic medication reconciliation. Potentially, a false sense of security of accurate medication reconciliation and administration exists with use of electronic technology. Various barriers to electronic medication reconciliation include conducting an improper history with an inadequate number of open–ended questions that will encourage patient input, inadequate support from system technology, and lack of established best practices. It is important to involve the patient, healthcare providers, and leadership in the process. Several investigators concluded bar-coded technology and electronic medication reconciliation reduce medication errors (Kerr, Heelon, & Higgins, 2010; Paoletti et al., 2007; Poon et al., 2010; Wang, 2011). The purpose of this study is to identify the accuracy of electronic medication reconciliation upon admission compared to discharge.

Theoretical Framework

One strategy to improve quality and prevent medication errors is to properly conduct medication reconciliation. Proper medication reconciliation entails collection of a detailed medication history with open-ended questions, accurate documentation of medication reconciliation, and congruence with electronic technology. Changing processes supporting medication reconciliation is a challenge for healthcare systems. Rogers' theory of Diffusion of Innovations informs the process of change and adoption of improved medication reconciliation systems. Roger's explains the theory of diffusion from a change communication process and studies its effects on the system.

Method

Study Design & Sample

A retrospective electronic chart review (n=150) was conducted at a tertiary care safety-net hospital in Suffolk County, New York, between August 2014 and February 2015 using a data extraction tool created for the study. Electronic charts for patients were obtained for review after discharge from the Cardiology and Medical Surgical Unit. Target population were patients admitted directly from the Emergency department to cardiology and medical surgical unit. A power analysis indicated that a sample size of 150 patients (n=150) at a power of .80 and alpha of .05 was adequate to detect small correlations (r=. 25). Medication reconciliation conducted at admission and discharge was examined for medication discrepancies for patients that met the inclusion and exclusion criteria (Table 1). Non-modifiable predisposing factors for medication reconciliation included age, gender, marital status, ethnicity, and comorbidities. Modifiable precipitating factors examined were medication discrepancies, change in medication regimen on

discharge, poly pharmacy, critical lab values and combination drugs. Variables were analyzed using descriptive statistics (Table 2)

Procedure

The electronic charts of patients for this study were identified directly by the investigator at a tertiary care safety net hospital in Suffolk County, New York. Data were collected for those electronic charts that met the inclusion and exclusion criteria. Medication reconciliation is completed by the provider admitting the patient within 24 hrs of admission and the reconciled electronic charts will be identified by a check sign at the admission and discharge icon on the right hand side of the computer. Subject details were coded to protect patient privacy. Human subjects approval was obtained at the institution of the principal investigator.

Analysis

SPSS statistical software was used to analyze the data. Descriptive statistics were used for the study sample demographics, modifiable and non-modifiable factors. Pearson's Chi Square was used to compare the relationship between discharge medication reconciliation errors and type of discrepancies that showed a statistical significance ($p<0.05$).

Results

The sample of 150 patients (mean age 58.8 years, SD 9.4) had more males and was predominately white. Results suggest prevalence of medication discrepancies were detected, corrected and significant in greater than 60% of discharge medication reconciliations (Figure 2). 80% patients discharged home with change in medication regime. A majority (71%) patients reported being on five medications or more. Comorbid illnesses include 86% hypertension, 71% diabetes mellitus; 67% hyperlipidemia; 60% coronary artery disease (Figure 1). Type of medication discrepancies in the form of missed dose, double dose were detected and corrected in

60% of the cases and 8% remained undetected. A Pearson's Chi Square was used to compare the discharge medication reconciliation errors with the type of discrepancies that showed a significant difference ($X^2 = 96.061$, df= 3, p=0.00).

Discussions

The key results of this study can warrant the need for provider understanding and the system compliance to provide quality and safety to our patients. The results are; (a) Medication error still exists despite electronic technology. (b) The documentation is complete as far as the information entered is accurate. (c) There is a false sense of security with electronic medication reconciliation. Medication reconciliation is a complex process that requires compliance and time. The study has shown that it takes at 30 mts to correct the medication errors and 80% of the time patients go home with a change in their medication regime. This is costly in terms of nursing workload. Nurses instead of educating the patients on their new medication regime, is engaged in getting the medication discrepancies corrected. During this whole process, patient's stay gets prolonged by at least 30mts, affecting the financial burden of the institution and patient satisfaction. There is definitely a need for further knowledge and compliance with regards to adapting the process of electronic medication reconciliation. Our ultimate goal should be to provide patient quality and safety.

Limitations

Like any study there are limitations that interfere with the findings. Given the study was done in a single institution and only on two units in the hospital, generalizability is limited. Electronic documentation differ from institution to institution and technology play a vital role. Medication

discrepancies were documented differently within the two units. Another limitation is that the organization recently (a year ago) introduced electronic technology, hence to reach compliance may need more time. Despite the above-mentioned limitations, the results of this study have significant implications for clinical practice.

Implications

Discharge Medication Reconciliation is costly in terms of nursing workload. Detected discharge medication reconciliation took 30 minutes or less to get discrepancies corrected. Delay in discharge to correct medication discrepancies may have negative impact on patient satisfaction and financial management of the institution. Outcomes rely on health care provider's ability to identify risk factors and entering complete accurate information.

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	INCLUSION CRITERIA	EXCLUSION CRITERIA
1.	Community dwelling adult inpatients over the age of 18	Patients transferred from other units within the hospital
2.	Patients admitted from emergency room to Cardiology unit and medical surgical unit	Patients transferred in from other facilities
3.	Patients on one or more prescription medications	Patients with Pharmacist-assisted medication reconciliation

TABLE 1 represents the criteria for sample selection

Table 2: represents the modifiable and non-modifiable factors for discharge medication reconciliation

VARIABLES	Discharge Medication Reconciliation N=150 (%)	Standard Deviation SD
Modifiable Variables		
Hypertension		
Yes	129 (86)	0.349
No	21 (14)	
Coronary Artery Disease		
Yes	90 (60)	0.492
No	60 (40)	
Hyperlipidemia		
Yes	101 (67)	0.473
No	49 (33)	
Diabetes Mellitus		
Yes	107(71)	0.456
No	43(29)	
Atrial Fibrillation		
Yes	26 (17)	0.378
No	124 (83)	
Cancer		
Yes	12 (8)	0.273
No	138(92)	
Pneumonia		
Yes	4 (6)	0.197
No	144(96)	
COPD		
Yes	15(10)	0.302
No	135(90)	

Table 2 continued

Variables	Discharge Medication Reconciliation N=150(%)	Standard Deviation SD
Discharge Medication reconciliation error		
Yes	102(68)	0.469
No	48(32)	$X^2 = 96.061$, df=3, P=0.00 (<0.05)
Poly pharmacy		
Yes	107 (71)	0.456
No	43 (29)	
Combination Medication		
Yes	28(19)	0.394
No	122(81)	
New Med on discharge		
Yes	122(81)	0.288
No	28(19)	
Non-modifiable variables		
Age in years		
Mean	58.8	9.454
20-55	51(34)	
56-86	99(66)	
Gender		
Male	114(76)	0.429
Female	36(24)	

Ethnicity		
Caucasian	117(78)	0.913
African American	13(9)	
Asian	5(3)	
Hispanic	5(3)	
Other	10(7)	
Marital Status		
Married	95(63)	1.006
Divorced	38(25)	
Widowed	10(7)	
Single	7(5)	
Time of Admission		
Weekday	116(77)	0.479
Weekend	34(23)	

Table 2 represents the modifiable and non-modifiable factors for discharge medication reconciliation

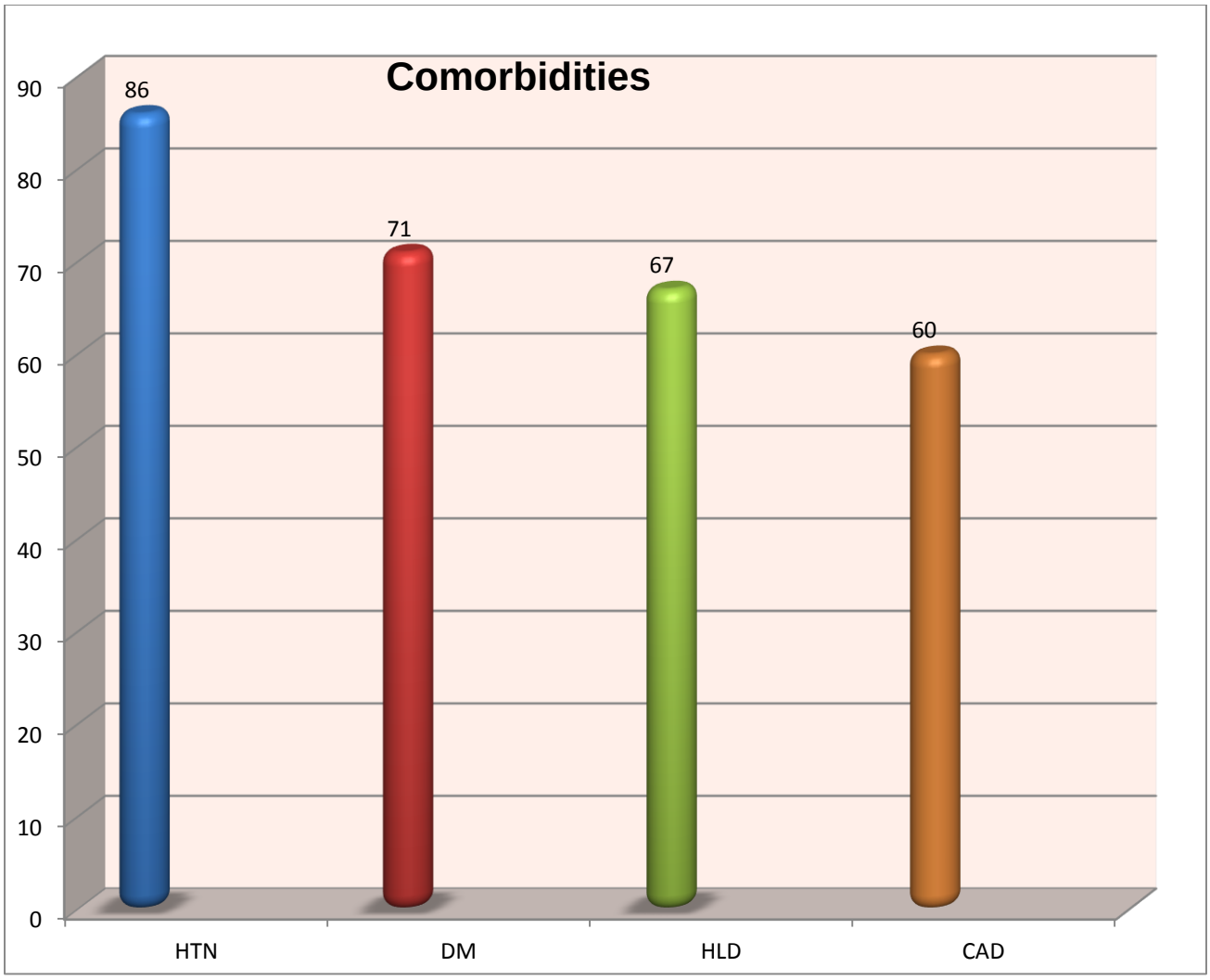

Figure 1 shows the comorbidities in descending order

Abbreviation Key
HTN- Hypertension
HLD- Hyperlipidemia
CAD- Coronary Artery Disease
DM- Diabetes Mellitus

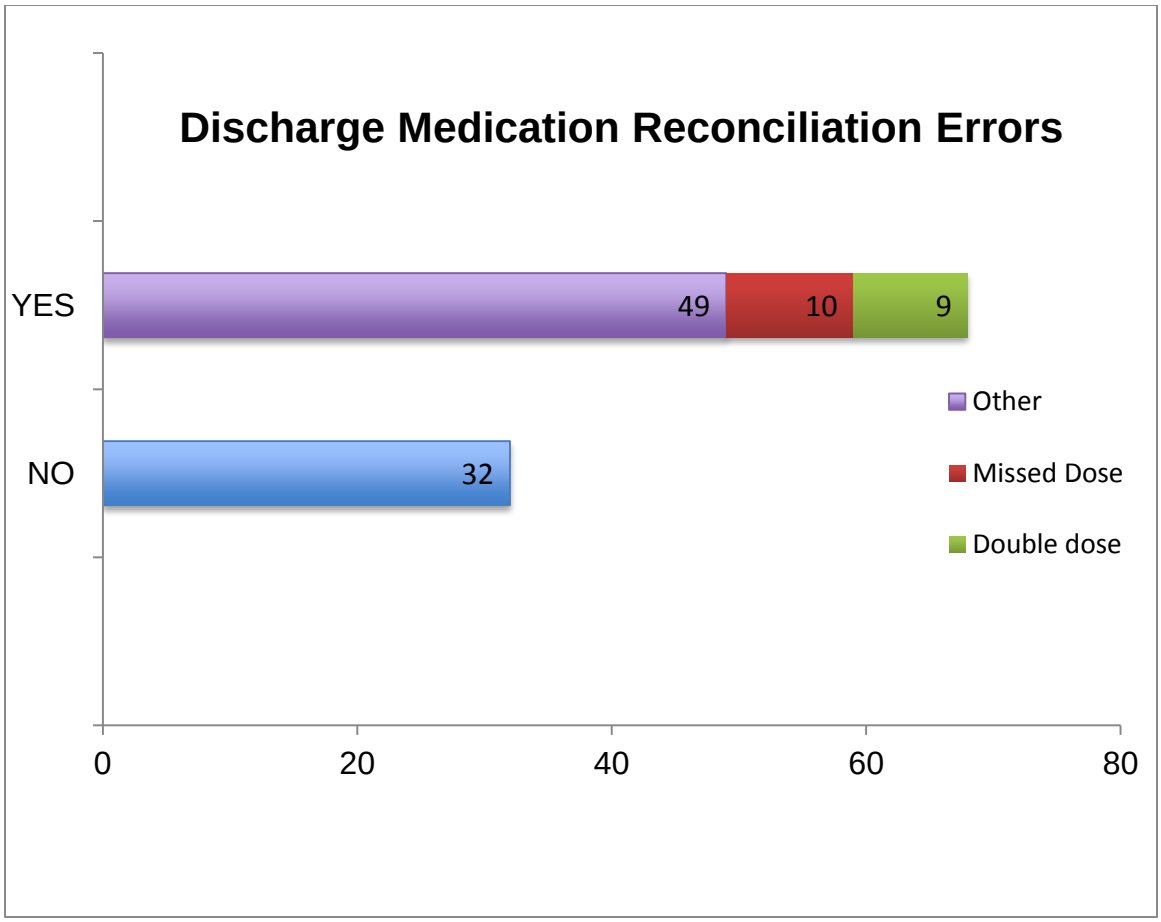

Figure 2 shows the Discharge Medication Reconciliation Errors in relation to type of discrepancy

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