

Article

Impact of Pharmacist Facilitated Discharge Medication Reconciliation

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Abstract: Preventable adverse drug events occur frequently at transitions in care and are a problem for many patients following hospital discharge. Many of these problems can be attributed to poor medication reconciliation. The purpose of this study was to assess the impact that direct pharmacist involvement in the discharge medication reconciliation process had on medication discrepancies, patient outcomes, and satisfaction. A cohort study of 70 patients was designed to assess the impact of pharmacist facilitated discharge medication reconciliation at a 204-bed community hospital in Battle Creek, Michigan, USA. Discharge summaries were analyzed to compare patients who received standard discharge without pharmacist involvement to those having pharmacist involvement. The total number of discrepancies in the group without pharmacist involvement was significantly higher than that of the pharmacist facilitated group.

Keywords: medication reconciliation; hospital discharge; pharmacist facilitated; medication errors; pharmacy; discharge; medication discrepancies

1. Introduction

Preventable adverse drug events (ADEs) occur frequently at transitions in care, most commonly following discharge with an occurrence rate of 11%–23% of patients [1–8]. Up to 50%–60% of these

are considered to be preventable or ameliorable [4–8]. Poor medication reconciliation and communication at discharge are responsible for many of these medication errors and result in ADEs [3,9–11].

Pharmacists should be directly involved in the medication reconciliation process considering the distinct knowledge and skills they possess relating to medication therapy [12]. The involvement of pharmacists in the discharge process may reduce adverse outcomes [12–17]. The American Society of Health-System Pharmacists has a policy stating that pharmacists should be leading and coordinating the interdisciplinary development, implementation, maintenance, and monitoring of the effectiveness of the medication reconciliation process [13].

The objective of this study was to assess the impact that direct pharmacist involvement in the interdisciplinary patient discharge process through medication reconciliation will have on the number of discrepancies, patient outcomes, and hospitalist satisfaction.

2. Methods

2.1. Setting and Participants

The study took place over a two-month period at Battle Creek Health System (BCHS), a 204-bed community hospital in Battle Creek, Michigan, United States where many of the patients are managed by the hospitalist service. The hospitalist service is a group of physicians that have a primary focus of delivering medical care to patients' during their hospitalization in place of their primary care physicians. Those patients eligible for inclusion in the study were adult patients at least 18 years old, with at least 1 discharge medication, discharged during the study period, and were medically managed by the hospitalists. The standard care study period took place during December 2010 and the intervention period took place during January 2011. During these study periods, 40 patients were recruited to the standard care group and 30 patients were recruited to the intervention, giving a total number of 70 patients included in the study.

2.2. Design

A cohort study was designed to assess the impact of pharmacist facilitated discharge medication reconciliation within the hospitalist service. Two clinical pharmacists were involved in the intervention phase. Patients were included in the intervention phase if the medication reconciliation was undertaken by the enhanced (hospitalist and pharmacist) team during the study period. The type of involvement of the pharmacists in discharge medication reconciliation included: rounding with the hospitalist, preparing discharge medication prescriptions for physician review and signature, speaking with the patient when necessary, discussing and resolving any potential issues identified in either the patient's home medication list or inpatient medication list with the hospitalist, and reconciling the inpatient list with the patient's home-list to provide the patient with a single medication list upon discharge. A discrepancy was defined as any incorrect or omitted medication information that had potential to cause an adverse event or lead to medication misuse. The standard care group differs from the intervention group due to: the lack of pharmacist involvement in preparing discharge prescriptions; lack of pharmacist involvement in reconciling the home and inpatient medication lists; fewer pharmacist discussions with the patients regarding their home medication list. The home medication

list was obtained on admission to the hospital by an Emergency Department pharmacist or nurse through discussions with the patients, caregivers, providers, and/or their pharmacies. The home medication lists have the potential to contain medication discrepancies that were not identified or corrected at admission or throughout the inpatient period.

The final reconciled discharge medication list was then reviewed, approved, and electronically co-signed by the hospitalist. The medication reconciliation was managed using the electronic based medication reconciliation program (Cerner®) that was in place at BCHS: a program that allows the reconciler to view the home medication list and current inpatient medication list. In this program each medication has check boxes to indicate if they are to continue, discontinue, or be modified. This was determined by the hospitalist and communicated to the pharmacist during rounding. The reconciled list was then provided to the patient upon discharge. A checklist was developed in order to facilitate and standardize the discharge medication reconciliation process. The standard care group had the medication reconciliation completed by the hospitalist, without the involvement of a pharmacist, using the same electronic medication reconciliation program.

The discharge medication lists in both groups were reviewed by one of three pharmacists. The pharmacists were excluded from reviewing the reconciled discharge medication lists that they themselves completed during the study. The review of the reconciled medication list was standardized between reviewers and was conducted using the facility's electronic medical records. Reconciled discharge medication lists for both the standard care and intervention groups were checked for possible discrepancies of medication therapy, categorized and then recorded in a database. The amount of time spent per reconciliation was also recorded to allow for an evaluation of the financial impact of pharmacist involvement.

The hospitalists were voluntarily surveyed using a written questionnaire designed to provide direct feedback before and after the study on their perception of the discharge process and pharmacy services. The questions in the survey assessed hospitalists' perceptions of a lower risk for drug error with medication reconciliation, the ease of the medication reconciliation process, satisfaction with the current discharge process, desirability of pharmacist involvement in the discharge process (as in the intervention phase), and the provision of complete, accurate, and easy to understand discharge medication lists for patients.

2.3. Measurement

The primary outcome measure was medication discrepancies present at discharge, with secondary measures of satisfaction of hospitalists with the new practice and number of discrepancy free patients. For the primary outcome, discharge medication lists were analyzed to determine the number of medication discrepancies identified. This was undertaken after the study patients were discharged. Medication discrepancies were defined as any variances, that have the potential to lead to adverse drug events, between: the actual discharge medication list; compared with home medication list; inpatient medication list; new prescriptions; allergies; medication appropriateness; and the prescribers' intentions for the medication use. Identified medication discrepancies were classified into the following groups: therapeutic duplications; incorrect or omitted dosage; directions and/or special instructions needed to assist with proper use of the medication; significant drug or disease interactions; the potential for

allergic reaction; contraindications; and “other”. The number of medications per patient between the two groups were also tested for any statistical differences. The surveys contained a set of five questions relating to the discharge process using a Likert Scale of 1 (strongly agree) to 5 (strongly disagree). There was also an area in the survey for additional comments.

2.4. Statistical Analysis

Continuous variables such as medication discrepancies and number of medications were analyzed using the unpaired t-test. Nominal variables such as number of patients without any medication discrepancies were analyzed using the Chi-Squared test. A two tailed α was set at 0.05 to test for significance. All analyses were conducted using Microsoft® Excel® 2010 Analysis Toolpak (Microsoft Corporation, Redmond, WA, USA).

3. Results

The study enrolled a total of 70 patients over a two-month period, see Table 1 for group specifics. The mean number of medications per patient in the standard care group and the intervention group were not found to be significantly different.

Table 1. Patient data by group.

| Patient Characteristics | Standard Care N = 40; Intervention N = 30 | | p Value |
|--|---|--------------------|---------|
| Male (percent) | 17/40 (43%) | 19/30 (63%) | 0.084 |
| Age range (mean); (standard deviation) | 31–89 (63); (17) | 22–86 (57); (18.2) | 0.171 |
| Total number of medications (standard deviation) | 423 (5.9) | 280; (6.8) | |
| Mean medications per patient | 10.6 | 9.3 | 0.418 |

3.1. Discrepancies

The total number of discrepancies in the standard care group was significantly higher than in the intervention group, see Table 2. Three of the six individual discrepancy categories were found to have significant reduction in discrepancies in favor of the intervention. The three categories were incorrect or omissions in dosage, frequency, and special instructions. The category with the most discrepancies in both groups was special instructions which was significantly lower in the intervention group (9 (3.2%) vs. 45 (10.6%)). The second most common category of discrepancy in both groups was dosage which also was significantly lower in intervention group (5 (1.8%) vs. 28 (6.6%)). The third most common category of discrepancy in both groups was frequency which was also significantly lower in the intervention group (1 (0.4%) vs. 14 (3.3%)). Out of the 40 patients in the standard care group 8 (20%) had no identified medication discrepancies present in their provided discharge medication list. In the intervention group out of 30 patients 19 (63.3%) had no identified medication discrepancies, which was significantly lower than the standard care group ($p < 0.001$).

One of the most common incorrect or omitted special instructions that was found was as needed medications that were listed with no indications such as anxiety, cough, shortness of breath, headache, pain, muscle spasm, *etc.* Some examples of discrepancies classified as “other” include therapeutic

duplications and missing medications that were supposed to be continued. The average time spent per facilitated medication reconciliation was found to be 16 min.

Table 2. Medication discrepancies.

| Discrepancy Type | No. (%) | | <i>p</i> Value |
|----------------------|--|--|-------------------|
| | Standard Care (N = 40; Total # of Meds = 423) | Intervention (N = 30; Total # Meds = 280) | |
| Wrong Drug | 5 (1.2%) | 0 (0%) | 0.133 |
| Dosage | 28 (6.6%) | 5 (1.8%) | 0.002 |
| Dosage Form | 2 (0.5%) | 0 (0%) | 0.155 |
| Route | 4 (0.9%) | 0 (0%) | 0.103 |
| Frequency | 14 (3.3%) | 1 (0.4%) | 0.002 |
| Special Instructions | 45 (10.6%) | 9 (3.2%) | <0.001 |
| Other | 10 (2.4%) | 0 (0%) | 0.086 |
| Total | 108 (25.5%) | 15 (5.4%) | <0.001 |

3.2. Satisfaction

A total of 5 surveys were completed. Hospitalist satisfaction improved in the post intervention survey for all of the questions. Survey scores (mean) where 1 = strongly agree to 5 = strongly disagree: Q1. Lower chance for error with the medication reconciliation process—standard care = 4; intervention = 2.5, Q2. The medication reconciliation process is easy to use—standard care = 2; intervention = 1, Q3. Satisfaction with the current discharge process—standard care = 2; intervention = 1, Q4. The hospitalists wanting pharmacists to continue enhanced involvement—standard care = 3; intervention = 1, Q5. Complete, accurate, and easy to understand discharge medication list were provided to the patients—standard care = 2.3; intervention = 2.

4. Discussion

Medication discrepancies after discharge from BCHS are a common occurrence when there is no pharmacist involved in the discharge process. The mean number of medications per patient was evaluated to take into account any potential affect that increased numbers of medications could have on complexity of the medication lists. This was not found to be statistically different between the groups. It was also identified that 32 (80%) of the provided discharge medication lists contained at least one discrepancy, in the standard care group. This can be compared to 11 (37%) of the discharge medication lists containing at least one discrepancy when pharmacists were involved (intervention group). The high discrepancy rates found when no pharmacist was involved in the discharge process is consistent with findings from many other studies [1,4,12,17,18]. Pharmacist facilitated medication reconciliation was associated with a reduction in all of the discrepancy categories and a significant reduction in the three most common categories which were dosage, frequency, and special instructions. These results are similar to the findings of others [12,17]. The type of discrepancies and the most common identified discrepancy varies between studies. This could be related to individual variations in the medication reconciliation process, the presence of an electronic medication list, or the use of different electronic programs. This is an area that warrants further investigation.

The potential financial impact that could result from implementation of this intervention at BCHS was also determined. Based on the average time per medication reconciliation in this study it was estimated that one pharmacist full-time equivalent (FTE) could complete approximately 25 medication reconciliations per day resulting in 6500 annually. This study showed an average of 2.2 fewer discrepancies per reconciliation. If this result is generalizable, this would amount to approximately 14,300 fewer discrepancies per year with pharmacist involvement. Literature has shown that approximately 0.9% of medication errors have been found to cause ADEs [19–21]. If this is applicable to our findings, then approximately 129 fewer ADEs per year would result with a full-time pharmacist designated to facilitate medication reconciliations. A conservative estimated savings from this was calculated to be \$150,000 per year [19–23]. Subtracting the cost of an average pharmacist FTE at BCHS (\$135,200) gave a net of +\$14,800 resulting in a return on investment of 10.9% annually, indicating a financially viable program.

The Joint Commission on Accreditation of Healthcare Organizations has recently made reconciling medication a national patient safety goal for accreditation [24]. Given the high rate of adverse drug events following discharge, many of which are seen as preventable, it is crucial to ensure medication reconciliation is properly completed [4–8]. In order to ensure proper medication reconciliation, pharmacists need be involved in the multidisciplinary care of patients. In addition they should be leading the team when it comes to medication therapy concerns. Many of the discrepancies identified were related to poor medication histories. So it is important to get a complete and accurate medication history at admission. Any problems or omissions that could not be resolved upon admission should really be corrected during the patient's stay to make sure that everything is correct by the time of discharge. Without a complete and accurate home medication list to reconcile with, the discharge medication list will more likely contain discrepancies.

The hospitalist satisfaction survey did show increased satisfaction with the new service. As noted in the results, there was a perceived lower chance for error, ease of use of the medication reconciliation process, satisfaction with new process, desire for pharmacists to continue involvement, and complete, accurate, and easy to understand discharge medication lists were provided to the patients. There was also a lot of positive direct feedback during the intervention phase. The hospitalist and discharge planners expressed that the intervention process had fewer errors, allowed more time for other patient-care activities, and they would like pharmacists to continue in this role. The overall opinion was that the pharmacists were making a noticeable difference and should be more involved in discharge medication reconciliation than the standard care model.

This study did have some notable limitations. The study design is a limitation. The lack of blinding and randomization can lead to potential selection and measurement bias. In addition, the subjective nature of the study design adds to the potential for measurement bias. Additional limitations include single site, small sample sizes, and duration of the study.

The results from this study have important implications for those health care organizations that are lacking pharmacist involvement in medication reconciliation. These results identify some patient safety and financial concerns. Further studies should address: if there is greater impact on specific patient populations; the amount of pharmacist involvement that provides the greatest impact; the most efficient ways to implement discharge reconciliation; and further describe the impact of pharmacist involvement.

5. Conclusions

Pharmacist facilitated medication reconciliation at the time of discharge is associated with a significant decrease in the total number of discharge medication discrepancies. Additional research is needed to further describe the impact of pharmacist involvement.

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Author Contributions

The co-author Todd Super contributed to this project through designing the research, performing the research, analyzing the data, and writing and editing the manuscript. The co-author Shaun Phillips contributed to this project through designing the research, analyzing the data, and editing the manuscript. The co-author Robert Coffey contributed to this project through designing the research, performing the research, and editing the manuscript. The co-author Sean Patterson contributed to this project through designing the research, performing parts of the research, and analyzing the data.

Conflicts of interest

The authors have no actual or potential conflicts of interest.

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