Postdischarge pharmacist medication reconciliation: Impact on readmission rates and financial savings

Meg Kilcup, Diane Schultz, Jim Carlson, and Bruce Wilson

Abstract

Objective: To assess the impact of ambulatory clinical pharmacist medication therapy assessment and reconciliation for patients postdischarge in terms of hospital readmission rates, financial savings, and medication discrepancies.


Practice description: Group Health is a nonprofit integrated group practice and health plan, operating 25 primary care medical centers and 5 specialty centers. Group Health’s practice design is a patient-centered medical home model.

Practice innovation: All patients identified as high risk for readmission were followed by Group Health care management. Patients in care management who received a phone call from a pharmacist 3 to 7 days postdischarge for medication therapy assessment and reconciliation were identified as the medication review group (n = 243). Patients who did not receive clinical pharmacist intervention were included in the comparison group (n = 251).

Main outcome measures: Readmission rates, financial savings, and medication discrepancies.

Results: Patients who received medication therapy assessment and reconciliation had decreased readmission rates at 7, 14, and 30 days postdischarge, with statistical significance at 7 and 14 days. Medication review versus comparison readmission rates were as follows: 7 days: 0.8% vs. 4% (P = 0.01); 14 days: 5% vs. 9% (P = 0.04); and 30 days: 12% vs. 14% (P = 0.29). Financial savings for Group Health per 100 patients who received medication reconciliation was an estimated $35,000, translating to more than $1,500,000 in savings annually. Of patients, 80% had at least one medication discrepancy upon discharge.

Conclusion: Most literature on medication reconciliation evaluates inpatient processes, whereas data on medication reconciliation postdischarge are limited. Our data support the hypothesis that medication assessment and reconciliation by pharmacists 3 to 7 days postdischarge can decrease readmissions and provide cost savings.

Keywords: Medication reconciliation, medication therapy assessment, pharmacists, medication discrepancies, transitions of care, savings, hospital discharge, readmission rates.

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Evidence indicates that 20% of patients discharged from the hospital to home will experience an adverse event during this transition and that approximately 66% to 71% of these events are associated with medications.\textsuperscript{1,2} Data indicate that 77% of patients discharged from the hospital receive inadequate medication instructions.\textsuperscript{3} In addition, a principal cause for insufficient medication instructions is lack of providers accurately updating medication regimens during the pivotal transition period.\textsuperscript{3}

Although health professionals care for patients with the best of intentions, the complexity of medical settings and systems leave providers unaware of the magnitude of issues affecting patient care across transitions.\textsuperscript{4} An important component of transitioning patients out of the hospital is a detailed review and reconciliation of drug orders between the two transition points: hospital and primary care records. The Agency for Healthcare Research and Quality defines medication reconciliation as a process to decrease medication errors and patient harm as follows: (1) obtaining, verifying, and documenting patients’ current prescription and over-the-counter medications, including vitamins, supplements, eye drops, creams, ointments, and herbal remedies, when they are admitted to the hospital or seen in an outpatient setting; (2) considering patients’ preadmission/home medication lists when ordering medications during hospital encounters and continuing home medications as appropriate, as well as comparing patients’ preadmission/home medication lists with ordered medications and treatment plans to identify unintended discrepancies; (3) verifying patients’ home medication lists and discussing unintended discrepancies with the physician for resolution; and (4) providing updated medication lists and communicating the importance of managing medication information to patients when they are discharged from the hospital or at the end of an outpatient encounter.\textsuperscript{5}

Although a considerable amount of literature supports inpatient medication reconciliation processes, studies in the ambulatory care setting are not as prevalent.

**Objectives**

The purpose of this evaluation was to assess the effectiveness of clinical pharmacist postdischarge medication assessment and reconciliation with regard to its impact on readmissions, financial savings, and rates of medication discrepancies compared with standard care.

**Setting**

Group Health Cooperative (Group Health) is a non-profit integrated group practice and health plan with approximately 675,000 members in Washington State, operating 25 primary care medical centers including 5 specialty centers. Group Health’s practice design is an evidence-based, patient-centered medical home model that emphasizes the core attributes of primary care (access, longitudinal relationships, comprehensiveness, and coordination), promotes a chronic care model, and maximizes the use of advanced information technology with improved patient access and outcomes.\textsuperscript{6} Group Health employs more than 50 clinical pharmacists, who serve as resources for each of the patient-centered medical homes. Group Health is contracted with many hospitals across Washington; seven of the hospitals care for the majority of Group Health patients, and each allows for review of discharge summaries via the Group Health electronic medical record (EMR).

**Methods**

**Evaluation design and population**

The evaluation was an ad hoc retrospective comparison and quality improvement analysis using integrated, electronic membership records for data collection. From September 2009 through February 2010, male and female Group Health patients discharged from any one of seven contracted hospitals and considered at higher risk for readmission—and therefore needing transition care management—were eligible for inclusion in the evalua-
Patients were excluded if they were discharged to a location other than home or home with home health services. Approval from the investigational review board was not required because the purpose of this analysis was to assess a postdischarge pharmacist intervention that was being adopted on a clinic-by-clinic basis by Group Health. The Human Subjects Review Office declared that the project was not research involving human participants covered by 45 CFR 46.

Hospital care teams determined which patients were at higher risk for readmission and in need of transition care management. The care teams considered various factors, such as (1) whether current hospitalization was a readmission, (2) whether patients had complex care plans, (3) primary diagnosis of chronic disease, (4) important medication changes during hospital stay, and (5) concerns of patients’ ability to self-manage. The list of five factors was determined at a Group Health rapid process improvement workshop, and multiple resources and references were considered to develop the list. The factors are an adapted and cross-functional version of Coleman’s care transitions program, focusing on health care services for improving quality and safety during handoffs. In addition, process walks and internal readmission data, along with other external literature, were reviewed to determine these factors.

Patients in care management received a call from a care management liaison nurse 1 to 2 days postdischarge. Nurses focused the conversation on reviewing red flags (warning signs) for the patient, reviewing follow-up appointments, and answering patients’ questions. The call did not include an in-depth, comprehensive conversation with patients regarding medication therapy. Nurses informed patients in the medication review group to expect a phone call from a pharmacist in the following days for a more detailed medication review.

Patients who received a call from a pharmacist 3 to 7 days postdischarge were included in the medication review group, whereas those who did not were included in the comparison group. The medication review and comparison groups were not selected by randomization. They were identified retrospectively based on whether a clinical pharmacist carried out medication reconciliation. The comparison group patients did not receive medication reconciliation because they received care at a Group Health primary care clinic that was not currently offering clinical pharmacist medication therapy assessment and reconciliation for postdischarge patients.

The primary objective of this evaluation was to determine the impact of clinical pharmacist medication therapy assessment and reconciliation for patients postdischarge on hospital readmission rates and financial savings. A secondary outcome was the frequency of medication discrepancies for patients who received clinical pharmacist medication reconciliation.

Medication review
Clinical pharmacists received daily reports of Group Health patients discharged from the seven contracted hospitals at which most Group Health patients are treated. Pharmacists filtered the report for patients in care management, receiving care at a Group Health primary care clinic, and discharged to home or home with home health services. After identification of appropriate patients, the pharmacist made a note to call patients on the third day postdischarge.

Before the call, the pharmacist reviewed the discharge summary from the hospital, which becomes available in the Group Health EMR within 48 hours of patient discharge. The pharmacist compared the discharge summary with the current Group Health medication list to identify any discrepancies between the documents and conclude which medications the patient should be taking. At two of the hospitals, clinical pharmacists had read-only access to hospital EMRs, allowing additional information to be available for medication reconciliation.

After preparation, pharmacists called patients at least 72 hours after discharge. If pharmacists were unable to reach a patient, they stopped calling (1) after three attempts, (2) if a week passed since discharge, and/or (3) if the patient already had an office visit with his/her physician or specialty care provider in which medications were reconciled.

The phone conversation with the patient included a comprehensive medication therapy assessment of the medication regimen the patient was recommended to follow after discharge. The pharmacist reviewed any unexplained discrepancies or drug therapy problems and discussed any changes that the patient needed to be aware of. The pharmacist provided the patient with an opportunity to ask questions. The goal of the phone assessment was to ensure the patients had a clear understanding of the purpose of each medication, how each medication was intended to work, common safety concerns, and how to take each medication as intended.

Following the phone call, the pharmacist documented the medication reconciliation telephone encounter in the Group Health EMR. If any discrepancies or drug therapy problems were noted during the comparison of documents or in the phone conversation, the pharmacist made note of them in the encounter. This encounter was sent to the patient’s primary care provider or, if appropriate, the specialty provider. If new prescriptions were required as a result of the hospital stay, the pharmacist pended new orders to the appropriate provider for review and approval.

In addition, pharmacists documented medication discrepancies and other pertinent data in a data collection tool. Pharmacists noted medication discrepancies (medication omissions, therapeutic duplicates, dose changes, discontinued medications, and drug–drug in-
teractions) and primary care clinic, discharge hospital and date, discharge summary availability, and clinical pharmacist time spent per medication reconciliation case.

**Outcomes**

The primary outcomes were rate of hospital readmission and financial savings for Group Health. Readmission rates for patients in the medication review and comparison groups were calculated by using unadjusted proportions of patients who were readmitted to the hospital at 7, 14, and 30 days postdischarge. Financial savings were calculated by using a conservative cost for readmission and the cost of labor for pharmacist medication assessment and reconciliation.

A secondary outcome was the rate of medication discrepancies for patients who received clinical pharmacist medication reconciliation. Rates of the following medication discrepancies were calculated based on the following data collection tool elements: medication omissions, therapeutic duplicates, dose changes, discontinued medications, and drug–drug interactions. Drug–drug interactions were broken into classifications identified by First Data Bank.8

**Data analysis**

Readmission data on patients discharged on September 1, 2009, through February 15, 2010, were obtained through Group Health daily admission reports. Discharge and admission dates were used to determine the 7-, 14-, and 30-day readmission rates. The 7-, 14-, and 30-day readmission rates excluded readmissions that occurred before day 3 postdischarge as a result of the first date of intervention being day 3 postdischarge. Demographic characteristics, as well as admission and discharge diagnosis, were identified by Group Health administrative and membership databases. For patients older than 65 years, the number of high-risk medications in the elderly, adapted from the National Committee for Quality Assurance’s 2010 Healthcare Effectiveness Data and Information Set,9 were captured as well. For readmission rates and binary baseline characteristics, group differences were tested using a two-sample Z-test for the difference in proportions. When sparse cells were present (<5), Fisher’s exact test was used. For continuous measures, a two-sample test was used. \( P < 0.05 \) was defined as statistically significant.

**Cost-savings calculations**

For Group Health enrollees, we estimated that the cost of a readmission is $10,000 for medical admits. This cost value is based on 2010 readmissions, including all lines of business and all geographies for 30-day readmissions. The value does not include normal newborn, chemical dependency, mental health, or surgical patient bed types. The value does not include fee-for-service business. Some costs were estimated based on similar lines of business and type of stay in which direct expenses were not available. This is a direct expense and does not include any copays, cost shares, or deductibles that patients may pay themselves. Group Health administration and management verified the financial assumptions.

To calculate net financial savings, we identified the cost for pharmacist labor required to carry out medication reconciliation and drug therapy assessment. According to Group Health human resources, the cost for a starting clinical pharmacist at Group Health in 2010 was $73.33 per hour; this includes the cost of employee benefits. Our data indicate that the total clinical pharmacist time per patient, including preservice, intraservice, and postservice work, averaged 37 minutes, resulting in a labor cost of $45.22 per patient.

**Results**

A total of 494 members were included in the retrospective analysis: 243 patients in the medication review group and 251 in the comparison group. Table 1 shows the baseline characteristics of the total population, and Table 2 shows baseline characteristics by study group. Table 3 describes the top admission diagnoses of the readmitted patient population.

**Readmission rates**

The study results are provided in Table 4. At 7 days postdischarge, 2 patients in the medication review group (0.8%) and 11 patients in the comparison group (4%) were readmitted to the hospital \( (P = 0.01) \). At 14 days postdischarge, 11 patients in the medication review group (5%) and 22 patients in the comparison group (9%) were readmitted to the hospital \( (P = 0.04) \). At 30 days postdischarge: 28 patients in the medication review group (12%) and 34 patients in the comparison group (14%) were readmitted to the hospital \( (P = 0.29) \). Both the 7- and 14-day readmission rates were statistically significant.

<table>
<thead>
<tr>
<th>Table 1. Baseline characteristics of total population</th>
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<tbody>
<tr>
<td><strong>Characteristic</strong></td>
</tr>
<tr>
<td>n</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Length of stay at first admit (days)</td>
</tr>
<tr>
<td>No. of prescription medications</td>
</tr>
<tr>
<td>No. of over-the-counter medications</td>
</tr>
</tbody>
</table>
ExpEriEncE  PHARMACIST MEDICATION RECONCILIATION

Financial savings were calculated from 14-day readmission data, which indicated a statistically significant reduction in readmissions. A labor cost of $45.22 per medication reconciliation translates to $4,522 for each 100 patients receiving medication reconciliation. The NNT of 25 corresponds to four readmissions prevented per 100 patients. With the cost of readmission estimated at $10,000, this equals a gross savings of $40,000 per 100 medication reconciliation services. Subtracting the cost for pharmacist labor ($40,000 – $4,522) results in a net savings per 100 patients of $35,478.

In 2010, clinical pharmacists were completing medication reconciliation for approximately 82 patients per week, which equals 4,280 patients who received the service in that calendar year. Converting savings per 100 patients ($35,478) to 4,280 patients yields an annual net cost savings of approximately $1,518,600 as a result of preventing readmissions.

Medication discrepancies
Table 5 shows medication discrepancy results. Clinical pharmacists documented findings in the data collection tool for 240 of the 243 patients who received medication reconciliation. More than 80% of patients had at least one medication discrepancy after discharge, with many patients having multiple discrepancies. Drug–drug interactions were stratified into the following First Data Bank Categories: eight level 1 interactions (clearly contraindicated), seven level 2 interactions (potential for severe adverse reactions), and nine level 3 interactions (potential for moderate adverse reactions).

Discussion
Hospital readmissions frequently are a reflection of the quality of the transitional care process provided by patients’ health care providers. Medication reconciliation has been identified as a key component in reducing medication errors and subsequent adverse events.10 The majority of available literature on medication reconciliation evaluates processes taking place while patients are in the hospital. However, in the past few years, literature has emerged providing evidence that pharmacist medication reconciliation postdischarge is associated with decreased readmission rates and with decreased medication discrepancies and adverse events associated with drug therapy problems.
The goal of the current evaluation was to serve as an ad hoc retrospective analysis to differentiate the impact of clinical pharmacist medication assessment and reconciliation. The evaluation found that medication therapy assessment and reconciliation after discharge were associated with statistically and clinically significant reductions in 7- and 14-day readmission rates. Further, the data reflect a trend toward decreased readmissions at 30 days postdischarge compared with patients who did not receive medication reconciliation. This outcome of decreased readmissions may have been a result of the identification of drug discrepancies and potential drug therapy problems through the medication reconciliation process.

Compared with standard care for postdischarge patients in care management, pharmacist medication therapy assessment and reconciliation may increase patients’ comprehension of their medication regimen, hospital discharge instructions, and potential adverse effects. The medication review also allowed for updated medication lists for review by primary care and specialty care providers during their initial appointment with patients postdischarge.

In addition, the data collection tool identified the high rate of medication discrepancies postdischarge.

**Limitations**

Because the current work was an observational cohort study that was not controlled or randomized, limitations are inherent. One limitation is that the difference in discharge diagnosis of patients in the two groups could not be controlled (Table 2). Although the differences were too small to be statistically significant, this does not preclude them from being different and potentially affecting the evaluation outcome. Also of importance, whether the admissions or readmissions were medication related was not discerned formally. Admit and discharge diagnoses were identified, but a formal and resource-intensive clinical review would have been necessary to identify whether the readmissions were specifically associated with medication therapy.

Another limitation was that patients who could not be reached by a pharmacist after three phone call attempts were not included in the final analysis. For those patients, their EMR medication list was updated; however, the patients were not able to receive a complete medication therapy assessment, which was an important part of the intervention.

In addition, pharmacists generally called patients on day 3 postdischarge; however, sometimes the phone call and medication reconciliation occurred during days 4 to 7 if patients were not able to be contacted on the third day after discharge. Because of this unpredictability, we can not be certain of the exact day patients were called in the week following discharge. Last, the evaluation was not powered to detect a statistically significant decrease in readmissions at 30 days; a larger sample size would be needed to detect statistically significant results at 30 days.

### Table 3. Most frequent admission diagnoses of readmitted patients

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Medication review group (n)</th>
<th>Comparison group (n)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest pain</td>
<td>3</td>
<td>1</td>
<td>0.29</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>4</td>
<td>0</td>
<td>0.02</td>
</tr>
<tr>
<td>GI hemorrhage</td>
<td>2</td>
<td>2</td>
<td>0.63</td>
</tr>
<tr>
<td>Syncope and collapse</td>
<td>2</td>
<td>1</td>
<td>0.56</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>0</td>
<td>2</td>
<td>0.53</td>
</tr>
<tr>
<td>Chronic airway obstruction</td>
<td>1</td>
<td>1</td>
<td>0.99</td>
</tr>
<tr>
<td>Intestinal obstruction</td>
<td>1</td>
<td>1</td>
<td>0.99</td>
</tr>
<tr>
<td>Pancreatic cancer</td>
<td>2</td>
<td>0</td>
<td>0.15</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1</td>
<td>1</td>
<td>0.99</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>1</td>
<td>1</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Two studies indicate that medication reconciliation after discharge is associated with resolution of medication discrepancies resulting from updated medication regimens postdischarge.\(^{11,12}\) One study found a 14% rate of discrepancy, while another found a 70% rate of discrepancy. Further, a study by Boockvar et al.,\(^{13}\) found that adverse events associated with medication discrepancies were lower in a group of patients receiving medication reconciliation. In addition, three studies assessing readmission rates indicated a trend toward decreased rehospitalizations as a result of pharmacist medication reconciliation after discharge.\(^{14-16}\) In general, the previously mentioned studies evaluated medication reconciliation processes in which pharmacists completed medication reconciliation in an integrated care team and/or in collaboration with physicians, with varying degrees of assessment related to the intended purpose of each medication, effectiveness, safety, and adherence.

### Table 4. Number of readmitted patients

<table>
<thead>
<tr>
<th>Postdischarge timeline</th>
<th>Medication review group (n)</th>
<th>Comparison group (n)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>243</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td>7-day readmissions</td>
<td>2</td>
<td>11</td>
<td>0.01</td>
</tr>
<tr>
<td>14-day readmissions</td>
<td>11</td>
<td>22</td>
<td>0.04</td>
</tr>
<tr>
<td>30-day readmissions</td>
<td>28</td>
<td>34</td>
<td>0.29</td>
</tr>
</tbody>
</table>

### Table 5. Medication discrepancies

<table>
<thead>
<tr>
<th>Patients with ≥1 discrepancies (%)</th>
<th>Total no. of discrepancies in medication review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discontinued medications</td>
<td>48</td>
</tr>
<tr>
<td>Omissions</td>
<td>46</td>
</tr>
<tr>
<td>Dose changes</td>
<td>44</td>
</tr>
<tr>
<td>Therapeutic duplicates</td>
<td>18</td>
</tr>
<tr>
<td>Drug–drug interactions</td>
<td>8</td>
</tr>
</tbody>
</table>
or more days postdischarge.

Future considerations for analysis or clinical trials would be a larger sample size for increased power, randomization of patients to minimize confounders, and a process less dependent on manual data input.

**Conclusion**

Our evaluation shows that medication therapy assessment and reconciliation by clinical pharmacists post-hospital discharge can reduce readmissions, lead to financial savings, and contribute to patient safety. The data indicate that medication reconciliation at Group Health was associated with a statistically significant reduction in hospital readmission rates at 7 and 14 days postdischarge, as well as considerable financial savings to Group Health. In addition, we found that more than 80% of patients who received medication therapy assessment and reconciliation had at least one discrepancy resolved by a pharmacist. The findings support the role of pharmacist medication therapy assessment and reconciliation as a key step in the transitional care process from hospital to home.

**References**