

## Original Research

# Impact of a Meds to Beds Program on Re-presentation Rates in Medical and Surgical Patients at a Community Hospital

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## Abstract

### Background

While the benefits of bundled transitions of care services are understood, only a limited number of studies have analyzed the impact of a stand-alone bedside medication delivery service on repeat hospital encounters, and those published have reported mixed results.

### Methods

A retrospective analysis was conducted in medical and surgical patients at a large community hospital. Adult patients discharged from either the cardiology, medicine, pulmonary, orthopedic/spine surgery, or women's surgery unit and prescribed at least one new prescription upon discharge to home between September 2015 and March 2018 were included. The primary objective was to compare unplanned 30-day re-presentation rates in patients who received Meds to Beds services to those who did not. The secondary objective was to compare 30-day re-presentation rates by patient type. Re-presentation was defined as an inpatient admission, emergency department visit, or observational encounter for any diagnosis within the six-hospital health system. Chi-square and logistic regression tests were used to assess statistical significance, and the study was powered to detect a difference in the primary objective.

### Results

A total of 45,546 patients were included. Of those, 4,286 received Meds to Beds services (Intervention Group, IG) while 41,260 patients did not (Control Group, CG). Overall 30-day re-presentation rate was not statistically different (15% IG versus 15.3% CG, OR 1.0; 95% CI 0.9-1.1;  $p = 0.76$ ). However, the 30-day re-presentation rate was statistically lower for women's surgery (12.8% IG versus 15.6% CG,  $p = 0.03$ , NNT 36) and orthopedics/spine surgery patients (7.3% IG versus 10.2% CG,  $p < 0.01$ , NNT 34).

### Conclusions

While there was no statistically significant differences in overall 30-day re-presentation rates, there were significant reductions in two surgical patient subgroups. Avoidance of re-presentations and generation of prescription revenue outweighed program costs.

### Keywords

transitions of care; bedside medication delivery; patient readmission; hospitalization; medication adherence; pharmaceutical services; prescriptions; medication therapy management; disease management

## Background

Due to the high frequency of unintended hospital readmissions and the associated financial consequences, there is continued emphasis among health systems to reduce hospital read-

missions. In 2011, 3.3 million adult readmissions occurred in the United States with an associated hospital cost of \$41.3 billion.<sup>1</sup> The Centers of Medicare and Medicaid Services (CMS) implemented the Medicare Hospital Readmissions

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Reduction Program, which penalizes hospitals for readmissions. In the first year after implementation, over 2,200 hospitals were fined.<sup>2</sup> As a response, many health systems implemented transitions of care services such as post-discharge phone calls, discharge medication reconciliation and bedside medication delivery to reduce 30-day unplanned readmissions.<sup>3</sup> Despite these efforts, overall readmission rates have remained relatively flat.<sup>4</sup>

Upon hospital discharge, patients may be prescribed new medications. It is often assumed the patients will fill newly prescribed medications and continue therapy without interruption. Unfortunately, barriers exist that may preclude patients from filling and obtaining prescriptions at a retail pharmacy following hospital discharge. Barriers can include cost, transportation challenges, hospital discharge outside normal pharmacy hours or severity of illness. These barriers may also be more pronounced in patients who live in rural areas. It is estimated that approximately one-third of patients do not fill their prescriptions.<sup>5</sup> Furthermore, poor adherence to newly prescribed medications has been shown to contribute to higher readmission rates, increased health costs and mortality in certain chronic diseases such as asthma and diabetes.<sup>6</sup> One approach to ensuring patients have access to medications at hospital discharge is through bedside delivery of the prescriptions before being discharged. A bedside medication delivery service can mitigate some of these barriers upfront and ensure the patient leaves with the medication in hand.

Previous studies have demonstrated that transitions of care bundles, which include bedside discharge medication delivery, may help decrease hospital readmissions. For example, Christy and colleagues studied the impact of a bundled transition of care service, which included a four-month review of discharge medications, medication counseling, delivery of medications to the bedside, scheduling a follow-up appointment with the clinic and a follow-up phone call at seven days. These investigators reported that 30-day readmission rates were 5.7% in the treatment group compared to 13.8% in the control group (8.1% reduction,  $p = 0.08$ ). Although there was a reduction in the treatment group, the study was not ade-

quately powered to demonstrate a statistically significant difference.<sup>7</sup>

A limited number of studies have analyzed the impact of a stand-alone bedside medications delivery service and have reported mixed results.<sup>8-11</sup> Two of the studies demonstrated a reduction in 30-day hospital readmissions.<sup>8,9</sup> However, a larger study with over 30,000 patients that demonstrated a reduction in 30-day readmissions in medical or surgical patients failed to show that bedside delivery of medications at discharge was an independent predictor of representation.<sup>10</sup> The final study was underpowered and did not demonstrate a significant reduction in representations.<sup>11</sup>

This study aims to characterize further the sole impact of a bedside medication delivery program for a larger, more diverse patient population at a large community hospital that serves rural patients.

## Methods

### Design

This study is a Mission Hospital Institutional Review Board and Research Institute approved retrospective cohort comparison study. Data was extracted by the research team from electronic medical records and from reports that track transitional activities. Patients were evaluated over 2.5 years between September 2015 through March 2018.

### Participants and Setting

Mission Hospital is an 815-bed tertiary care community teaching hospital with approximately 150 patient discharges per day. It is the largest hospital within a six-hospital system that serves 18 counties in western North Carolina, many of which are rural counties. Three of the system hospitals are critical access hospitals. The retail pharmacy located within the hospital is open 7 AM–7 PM, Monday through Friday and 8 AM–4 PM on Saturdays.

Patients were included in the study if they were at least 18 years of age and discharged home from either the cardiology, medical, pulmonary, ortho/spine surgery or women's surgery unit with at least one newly prescribed discharge medication. From that patient group, those who opted to receive new prescriptions deliv-

ered to their bedside before discharge comprised the intervention group (IG), and those who did not comprised the control group (CG). Patients discharged to a non-home disposition such as a skilled nursing facility, rehabilitation center or hospice were excluded. All the units included in this study had the same degree of clinical pharmacy coverage.

### **Intervention**

The Meds to Beds (MTB) program at Mission Hospital was implemented in December 2014 after receiving funding from the American Society of Health-System Pharmacists (ASHP) Pharmacy Practice Model Grant. Following the grant, the service was expanded from two patient care units to ten patient care units. When a patient discharge order is placed by the inpatient physician, an on-site retail pharmacy technician is paged to visit the patient. The technician explains the program and offers the service to the patient. If the patient agrees to receive the service, the technician alerts the bedside nurse and retrieves the prescriptions for bedside delivery before discharge. The technician completes prior authorizations and addresses other potential barriers before prescription filling, dispensing and patient discharge. Counseling by the MTB pharmacist is also offered to the patient. If the prescription has any refills remaining, they are transferred to the patient's preferred community pharmacy. Although the program is voluntary, there was a 97.3% patient acceptance rate when offered the service during the first year of the program. Common reasons for refusal of the service were loyalty to preferred community pharmacies and lack of ability to provide payment at the bedside before discharge.

Not all patients in the CG were offered MTB services. For example, if they were discharged during the weekend or after pharmacy hours, the patients would not have been offered MTB services. Some patients received a discharge medication reconciliation review and a post-discharge phone call. However, since not all patients received these additional services, the variables were controlled for during analysis. Adherence was not assessed. Clinical pharmacy services provided to patients in both IG and CG were part of routine care, which includes high-risk medication reviews, pharmacist-authorized automatic renal dosing and

IV to enteral adjustments and participation in multidisciplinary rounds on designated units. Discharge medication reviews were based on specific patient criteria and discharge medication teaching was provided when the pharmacist was consulted for specific medications. These services were provided seven days a week on all shifts, but only a decentralized model was used on the weekday day shift. Interaction between the clinical pharmacist and the MTB program occurred when needed to resolve questions about medication access or discrepancies.

### **Outcome**

The primary outcome of this study was a 30-day re-presentation rate of the MTB intervention group compared to the control group. A re-presentation was defined as an inpatient admission, emergency department visit or observational status encounter for any diagnosis within the 6-hospital health system. The secondary objective was 30-day re-presentation rates by patient type, as defined by the specialty unit from which the patient was discharged.

### **Statistical Analysis**

Continuous and discrete variables were presented as the mean with standard deviation or median with interquartile range and nominal factors as number and proportion. Demographic and index visit characteristics were compared between the treatment and control groups using t-test, Mann-Whitney U test or chi-square test, as appropriate. Differences in the outcome of the patient 30-day re-presentation to the health system were compared between treatment groups using a chi-square and logistic regression test. Based on previously published assessments of the 30-day re-presentation rates at this institution, a 15% re-presentation rate at baseline was projected. To achieve 80% power, it was estimated that 28,006 patients were needed to demonstrate a 2% absolute reduction in re-presentation rates. Multivariable logistic regression was used to adjust for possible confounding factors such as age, race, sex, insurance type, number of disease states, encounter type, length of stay and patient type. Since not all patients received additional services, such as discharge medication reconciliation reviews and post-discharge phone calls, their variables were controlled

during analysis via multivariable logistic regression. Additionally, chi-square analysis was used to compare differences in re-presentation rates stratified by patient type. P-values less than 0.05 were considered to be statistically significant. All analyses were performed using SAS software v9.4 (SAS Corporation, Cary, NC).

**Results**

A total of 4,286 patients received MTB services and comprised the intervention group, while 41,260 patients were included in the control group. A total of 845 patients were excluded from the study due to missing data.

Demographic and clinical characteristics are summarized in **Table 1**. Due to the large sample size and disparity in the size of the two groups, small differences were statistically significant. The intervention group had slightly younger patients with a median length of stay (LOS) that was two days shorter than the control group. The intervention group also had a higher proportion of female and women’s surgery

patients, whereas the control group had a higher proportion of neurology patients. The top three primary admission diagnoses among the entire patient population based on ICD-10 codes were non-ST-elevation myocardial infarction (NSTEMI), chest pain and unstable angina. In the intervention group, 2,057 (48%) were medical patients, and 2,229 (52%) were surgical patients. The control group had 26,585 (64.5%) medical patients and 14,675 (35.5%) surgical patients. Also, 67.6% of patients in the study had governmental insurance, such as Medicare or Medicaid.

More than 9,000 prescriptions were dispensed through the MTB service over the 2.5-year study period with an average of 3 prescriptions per patient. The top 3 drug classes of medications dispensed were cardiac medications (e.g., beta-blockers), opioid analgesics and anticoagulants, which are all considered to be high-risk medications.<sup>12</sup> A breakdown of all drug categories dispensed through the MTB program is displayed in **Table 2**.

**Table 1.** Baseline Characteristics

Patient Demographics	Intervention (n=4,286)	Control (n=41,260)	P-value
Mean Age ± SD, years	60 ± 15	62 ± 16	<0.01
Gender, n (%) Female	2,523 (58.9)	21,111 (51.2)	<0.01
Median # of disease states (IQR)	14 (9–19)	14 (9–20)	0.02
Encounter Type, n (%)			<0.01
Inpatient	3,264 (76.2)	29,496 (71.5)	
Observation	1,022 (23.8)	11,764 (28.5)	
Discharge Unit, n (%)			<0.01
Cardiology	1,829 (42.7)	1,829 (42.7)	
Orthopedics/Spinal Surgery	955 (22.3)	10,930 (26.5)	
Women’s Surgery	1,030 (24.0)	3,745 (9.1)	
Pulmonary	430 (10.0)	4,107 (10.0)	
Neurology	42 (1.0)	4,669 (11.3)	
Median Length of Stay (IQR)	5 (2–6)	3 (2–6)	
Insurance, n (%)			<0.01
Governmental	2,740 (63.9)	27,886 (67.6)	
Commercial	1,391 (32.5)	11,619 (28.2)	
Self-Pay	155 (3.6)	1,755 (4.3)	

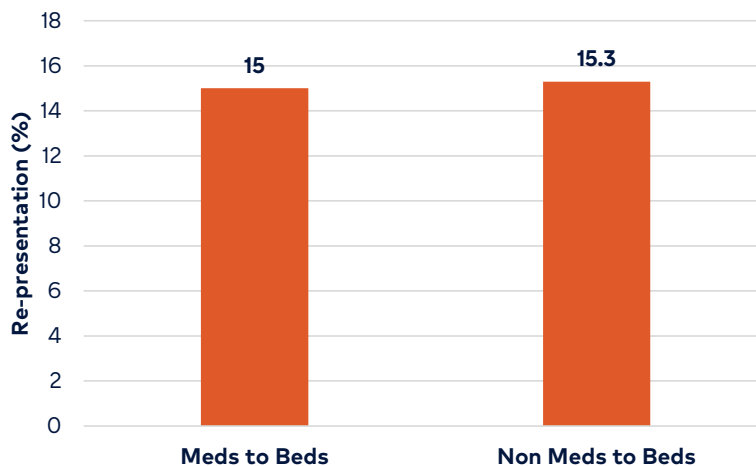
**Table 2.** Medication Categories Filled through Meds to Beds

Medication Category	Prescriptions Filled through Meds to Beds, n (%)
Cardiac Medications	2,478 (27%)
Opioid Analgesics	2,220 (24%)
Anticoagulants/ Hematopoietic Agents	924 (10%)
Gastrointestinal Agents	763 (8.3%)
Non-narcotic Analgesics	712 (7.7%)
Antibiotics	521 (5.6%)
Psychiatric Agents	327 (3.5%)
Vitamins/Supplements/Minerals	262 (2.8%)
Musculoskeletal Agents	192 (2.1%)
Corticosteroids	178 (1.9%)
Cold/Cough/Allergy	169 (1.8%)
Hypoglycemic Agents	147 (1.6%)
Bronchodilators	106 (1.2%)
Other	234 (2.5%)
	Total: 9,233

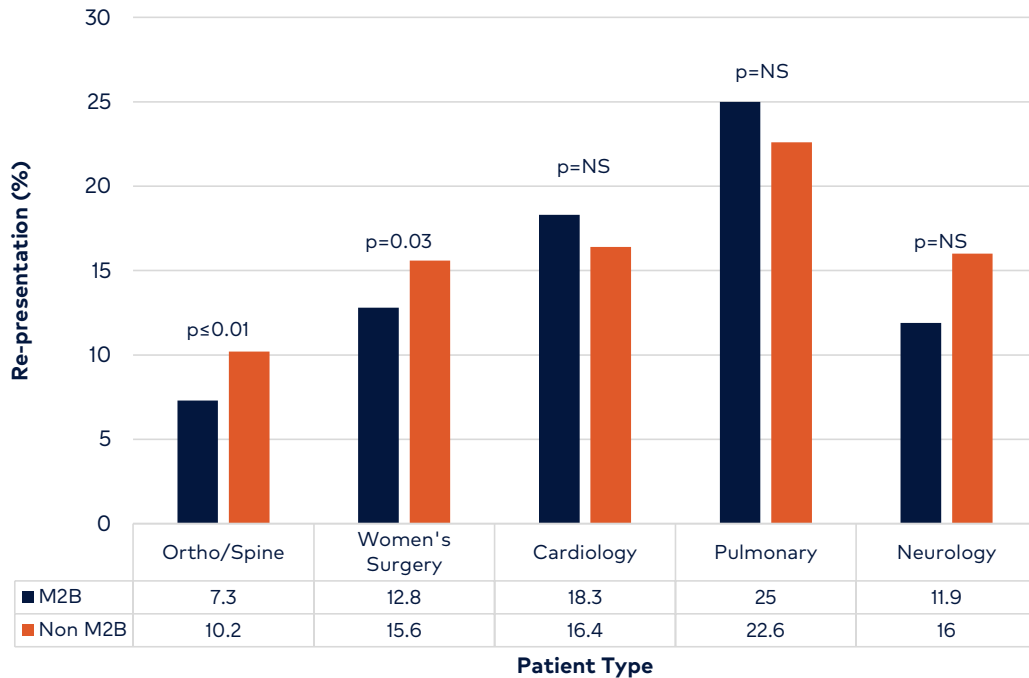
The overall 30-day re-representation rate was not statistically different between the intervention and control groups (15% IG versus 15.3% CG, OR 1.0; 95% CI 0.9-1.1;  $p = 0.76$ ). (**Figure 1**) However, a subgroup analysis based on patient type revealed that there were statistically significant differences in the 30-day re-representation rate in certain surgical populations. The 30-day re-representation rate was statistically lower in the intervention group for women’s surgery (12.8% versus 15.6%,  $p = 0.03$ ), as well as for orthopedic and spine surgery patients (7.3% versus 10.2%,  $p < 0.01$ ). (**Figure 2**) For women’s surgery, this rate represented a 2.8% reduction (number needed to treat, NNT = 36).

In orthopedic and spine surgery patients, this rate represented a 2.9% reduction (NNT = 34). Differences in 30-day re-representation rates were not statistically different in neurology (11.9% versus 16.3%,  $p = 0.44$ ), pulmonary (25.1% versus 22.6%,  $p = 0.25$ ) or cardiology patients (18.3% versus 16.4%,  $p = 0.05$ ).

Since there was not a statistically significant reduction in the entire population, a comprehensive cost avoidance analysis was not relevant. However, we did note that based on the average cost of re-representations in the surgical subgroups who appeared to benefit from the service, the economic benefits gained through



**Figure 1.** 30-Day Health System Re-representation Rates (N=45,546)



**Figure 2.** 30-Day Re-presentation Rates by Patient Type (N=45,546). NS=Not statistically significant

the generation of prescription revenue and avoidance of re-presentations outweighed the costs of providing the service.

### Discussion

This study demonstrates the plausibility of conducting a successful bedside medication delivery service at a community hospital despite limited resources. This bedside medication delivery service eliminates the burden of making a stop at the pharmacy after discharge as well as cost-related barriers in obtaining medications, and it allows medication questions to be answered with the product in hand. All of these factors ensure that patients are less likely to return to the hospital for unplanned presentations or have issues adhering to new medication instructions.

Rosen and colleagues predict that patients with poor medication adherence are also those patients at higher risk of readmission. Patients with low and intermediate adherence had readmission rates of 20% compared to a readmission rate of 9.3% for patients with high adherence ( $p = 0.005$ ).<sup>13</sup> Even for patients who do obtain prescriptions, the risk of a preventable adverse drug event (ADE) after discharge is significant. Forster et al. assessed the risk

of an ADE following hospital discharge. Of the 400 patients evaluated, 45 (11.3%) developed an ADE, of which 27% were preventable and 33% were correctable. The risk of an ADE per prescription was highest for corticosteroids, anticoagulants, antibiotics, analgesics and cardiovascular medications.<sup>12</sup> These medication classes accounted for approximately 60% of the prescriptions filled through the MTB program. Having these medications filled at the hospital before discharge, with an offer to counsel the patient on appropriate use, may reduce the risk of preventable ADEs that can occur from improper drug use.

As previously mentioned, a limited number of studies have analyzed the impact of a stand-alone bedside medication delivery service and reported mixed results.<sup>8-11</sup> Lash and colleagues studied the effects of their MTB program in roughly 350 medical-surgical patients and found that their service was associated with a lower likelihood of 30-day hospital readmission (odds ratio = 0.40, 95% confidence interval 0.190, 0.843,  $p = 0.016$ ).<sup>8</sup> On a larger scale, Comer and colleagues studied the impact of a discharge prescription program across 15 hospital units in a large health system on 7-day and 30-day readmission rates. The participating units included 5 medical (including 1 heart

failure unit), 5 surgical (e.g., spine, joint replacement, urology), 3 women and children's (including postpartum), 1 oncology, and 1 stepdown and intensive care. They found that participation in the discharge prescription program led to decreased odds of 7-day readmission by 20% and 30-day readmission by 16%.<sup>9</sup>

Lam and colleagues studied the effects of a pharmacy-driven bedside discharge medication delivery program on 30-day hospital readmission rates in a mixture of 30,916 medical and surgical patients at an academic medical center. Of those, 2,253 received bedside medication delivery while 28,663 patients received the usual care. Patients who received bedside medication delivery were less likely to have day 30-day readmissions (10.6% vs 12.8%,  $p = 0.002$ ). However, after adjusting for differences in baseline characteristics, bedside medication delivery was not an independent predictor of day 30-day readmission (adjusted odds ratio = 0.91, 95% CI 0.79–1.04,  $p = 0.17$ ).<sup>10</sup> Patel and colleagues also evaluated the impact of a meds to beds service on 600 adult internal medicine patients. The 30-day hospital reutilization related to their index visit was lower in the meds-to-beds group, but the difference was not statistically significant (8.0% in the meds-to-beds group versus 10.0% in the control group; odds ratio, 0.78; 95% confidence interval, 0.45–1.37), and the study was underpowered.<sup>11</sup>

The findings of this study align with those of Lam et al. and Patel et al. since this MTB evaluation did not demonstrate an impact on overall unplanned re-presentations. Yet certain populations of surgical patients witnessed reduced re-presentation rates. A subgroup analysis demonstrated statistically significant reductions in re-presentation in women's surgery patients and ortho/spine patients. An absolute reduction in 30-day re-presentations of 2.8% (NNT = 36) and 2.9% (NNT = 34) respectively have been considered clinically significant within the health system upon previously published transitions of care service evaluations.<sup>14</sup> Lam's study also included surgical patients: 1,145 (50.8%) surgical patients in the intervention group and 9,519 (33.2%) in the control group. However, they failed to conduct a subgroup analysis on this population.

Some limitations of this study include the

imbalance between the treatment and control group, resulting in marked differences in baseline characteristics. A re-analysis using propensity matching would mitigate this. Another limitation is the lack of baseline acuity measures or baseline evaluation of their risk for re-presentation. The MTB patients had a median 2-day longer length-of-stay than the control group, which may indicate that those patients had more severe illnesses or were in poorer health conditions more prone to frequent hospitalizations. This difference may have led to an underestimation of benefit from the MTB service and partially explain why there was no difference in the overall 30-day re-presentations. Another limitation is that the control group included patients who were discharged on the weekend, whereas the intervention group did not due to limited service hours for MTB. Weekend discharge is associated with a higher re-presentation rate.<sup>15</sup> Additionally, this study only evaluated encounters within our 6-hospital health system and was unable to account for interactions outside of the health system that may have occurred within 30 days of discharge. It is also important to note that this institution's 30-day re-presentation rate at baseline is approximately 15%, which is comparable to the national average.<sup>16</sup> It is more difficult to impact re-presentation rates that are already on par with the rest of the nation through transitions of care services. Finally, while this study detected a statistically significant difference in 30-day re-presentation rates in two surgical units, it was not powered to do so. However, assessing the impact on specific patient populations is useful especially when expanding the program to target certain patient care units that may gain more benefit than others.

In the future, consideration should be given to an expanded comparison of patients in the smaller rural, critical access hospitals within the health system. Additionally, 60- and 90-day re-presentation rates may be evaluated. Since the MTB program resolves cost and prior authorization barriers as well as transfers all refills to the patient's retail pharmacy of choice, there may be more long-term reductions in re-presentation rates. Additional considerations should also be given to an evaluation of patient satisfaction with the MTB program through the use of surveys or post-discharge phone calls.

## Conclusion

Overall, the MTB service in a large community health system did not impact overall unplanned 30-day hospital re-presentations but highlighted two surgical subgroups that may derive benefit through avoided re-presentations. From a quality perspective, the service ensured patients had prescriptions in hand at discharge, and revenue generation from prescriptions outweighed program costs. Additional and adequately powered subgroup analyses in special populations are warranted for future evaluation.

## Conflicts of Interest

The authors declare they have no conflicts of interest.

The authors are employees of Mission Hospital, a hospital affiliated with the journal's publisher.

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