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Multidose Medication Dispensing on Discharge: Effects on Compliance, Readmissions, and Cost in Patients with Chronic Obstructive Pulmonary Disease

By

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Multidose Medication Dispensing on Discharge: Effects on Compliance, Readmissions, and Cost in Patients with Chronic Obstructive Pulmonary Disease

Introduction: Hospital inpatients given multidose medications are often prescribed the same medication to be continued after discharge from the hospital. Commonly, the medication is disposed of at discharge and the patient is given a prescription. COPD is a debilitating disease with a high readmission rate and hospitalization cost. One of the mainstays to stabilize severe COPD patients' disease is adherence to their multidose inhaled medication regimen after hospital discharge. This study evaluated a clinical service dispensing multidose medications on discharge (MMDD) and providing pharmacist education to specifically target COPD patients.

Methods: This was a quasi-experimental before-after study. The first phase involved creation and implementation of a new clinical pharmacy initiative at the Harris Health System. Patients with COPD on included study multi-dose medications were prospectively identified. Clinical pharmacists responsible for these patients provided the patient with their COPD-related multi-dose medications used during their inpatient stay, along with appropriate medication counseling. Post-discharge fill compliance and 30-day readmission rates were compared before and after implementation of the program. Additionally, the costs of waste disposal charges were compared before and after implementation, and product and labor cost savings were calculated. The study received exempt status by The University of Houston Institutional Review Board and administrative approval by Harris Health System.

Results: One hundred sixteen out of 247 (47%) patients in the pre-intervention group were compliant on the measure of discharge fill compliance, versus 36 out of 36 (100%) in the intervention arm ($p<0.001$). Eighty-eight out of 412 patients from the pre-intervention group were readmitted within 30 days for an effective rate of 21.4%, versus 4 out of 54 patients who received the intervention for a rate of 7.4% and a relative reduction of 65.4% ($p<0.05$).

Conclusions: A MMDD program targeting COPD patients was successful in reducing 30-day readmissions and was associated with cost savings.

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Introduction

Background

Very often, hospital inpatients given multidose medications such as inhalers, insulin pens, ophthalmic preparations, etc., are prescribed the same medication to be continued after discharge from the hospital. Commonly, the medication is disposed of at discharge and the patient is given a prescription and asked to fill the medication at an outpatient pharmacy. When the patient arrives at the pharmacy, they often incur a copayment for the medication if insured; or potentially the entire cost of the medication, if uninsured. This form of practice with multidose medications raises concerns about its contribution to patient noncompliance and dissatisfaction. The outright unnecessary waste of products is also of concern, since the cost of the entire item is paid for by the patient or their insurer.

The concept of multidose medication dispensing on discharge (MMDD); a process in which a patient is given a medication that is appropriately labeled for outpatient use upon discharge, and pursuant to a physician's discharge order to continue the medication, is not a new or novel concept. Laws and/or rules by many states' boards of pharmacy have been adopted to allow for such a service. In fact, a 2011 survey of pharmacy directors asking about services related to dispensing multidose containers for continued use upon discharge found that approximately half of the respondents indicated they provide this type of service.

Much of the driving force for more purposeful and prudent use of healthcare resources has been associated with U.S. healthcare reform, a rough economic climate, frequent nationwide drug shortages, and environmental implications as a result of pharmaceutical waste.

There is currently, and has previously been much interest in a MMDD program's role in improving patient satisfaction and reducing costs associated with multidose

pharmaceutical waste. Value Based Purchasing (VBP), an incentive program, in part evaluates patient satisfaction. Higher patient satisfaction can aide in higher payment from VBP. There are at least two well publicized examples of MMDD programs being implemented for cost savings. First, at Spectrum Health in western Michigan, they were able to reduce their $1.56 million in multidose medication waste by 50%. Secondly, under a Veteran's Health Administration directive given pursuant to an employee recommendation, VHA facilities were able to collectively produce a net cost savings of $1.4million. Although MMDD programs have been used as a target to decrease waste, improve patient satisfaction, and save money, to the author's knowledge, there has not previously been a reported MMDD program specifically targeting a disease state with an aim at improving outcomes.

COPD

Chronic respiratory diseases have a major impact on healthcare quality and costs in the United States. For example, the incidence of chronic obstructive pulmonary disease, or COPD, is 5%, or approximately 15 million U.S. adults. Many patients receive care for COPD via walk-in visits to the emergency department (ED). This is a costly practice for the healthcare system (estimated cost of COPD-related ED visit is $650/visit). In addition, patients receiving care for COPD in the ED have a very high likelihood of subsequent hospitalization. In 2008, 60 day admission rates after a COPD related emergency department (ED) visit was found to be 18%. Readmissions after a hospitalization are even higher; reported at 31% (Dalal, et al. 2011). COPD inpatient admissions cost ranged from $7242 to $20,757 with mean readmission lengths of stay ranging from 4.5 to 16 days (Dalal, et al. 2011). Taking steps to manage readmissions of COPD will soon be vital to hospitals and healthcare systems within the United States. The Patient Protection and Affordable Care Act

of 2010 established the Hospital Readmissions Reduction Program (Section 3025). This is a penalty program which reduces reimbursement for readmissions of certain conditions. In October 2014 (U.S. Government FY 2015), COPD will enter into effect as a measure under this program. Payment may be reduced 3%, based on Diagnosis Related Group (DRG) reimbursement, if the hospital exceeds actual to expected all-cause readmissions for COPD patients.

The 2013 Global Initiative for Chronic Obstructive Lung Disease guidelines classifies COPD patients into four categories: A, B, C, and D. Patients with a category of C and D are considered likely to have an exacerbation. One of the recommended mainstays of treatment for patients with category C and D COPD is use of combination inhaled multi-dose medications. If taken routinely with proper technique, these medications have been shown to improve or stabilize lung function (Szafranski, et al. 2003; Calverley et al. 2003) Taken properly, these medications have also been shown to reduce hospitalizations (Welte, et al. 2009). Unfortunately, lack of education and financial concerns has limited the utility of these life-saving medications. A study of Medicare beneficiaries found that 31% of COPD patients were non-compliant with their inhaled medications due to cost. A cost burden of less than twenty dollars was related with a 1.31 fold increase in medication non-compliance (Castaldi, et al. 2010) Lowest income patients with COPD are also up to 22% more likely to require a hospital readmission compared to COPD patients with higher income (Elixhauser, et al. 2011). This cost burden effect has been correlated in qualitative studies as well (Goeman, et al. 2004; Santos, et al. 2010). Lack of patient education on the importance and proper use of inhaled medications also contributes to non-compliance and poor outcomes (Goeman, et al. 2004). Pharmacists have been shown to greatly improve education in these areas. A study

evaluating asthma patients demonstrated that education by a pharmacist on inhaled medications lead to increased proper technique and compliance with inhaled medications (Santos, et al. 2010).

Patient education along with dispensing of multi-dose medications upon discharge could have major effects on COPD disease control and decrease the economic burden of the disease by lowering readmission rates. Pharmacists are uniquely positioned to provide this clinical service due to their advanced pharmacotherapy knowledge, skill in teaching the proper use of these medications, and access to the medications and labels for dispensing purposes. Multi-dose medication dispensing at discharge is a practice that institutions have previously piloted for cost savings or waste reduction (VHA Directive 2011-001). However, multi-dose dispensing at discharge along with patient counseling has not been used to target COPD patients to increase compliance and improve outcomes. The purpose of this project was to initiate and evaluate a clinical discharge service targeting education and dispensing of multi-dose medications to improve clinical and economic outcomes in COPD patients.

Rationale

Prevention of readmissions for patients with COPD is highly dependent on symptom control via medication compliance. However, studies have demonstrated that an increase in cost burden to the patient is related to poorer compliance. The first fill of a medication is vital, as it can demonstrate to the patient the benefit of using that medication on controlling disease symptoms.

Harris Health System provides services to primarily indigent patients. Approximately 60% of patients do not have any form of medical or prescription insurance coverage. Inability to pay for prescription copays ($8) may be a significant detour ant for an inpatient

being discharged choosing not to fill their prescriptions. By providing the inpatient multi-dose container medications at discharge and pharmacist counseling, the patient will be positioned for improved medication compliance due to the strong likelihood the patient will experience the benefit of the medication and refill it. Dispensing the medication on discharge will also reduce medication in the waste stream, and provide disposal and medication cost savings to the Harris Health System. This multi-dose dispensing evaluation directly targeted a specific patient population at high risk for non-compliance and poor outcomes which served as a viable target population to meet the goal of reducing readmissions. If successful, this strategy can be expanded to target other diseases treated with multi-dose medications.

Study Objectives

The objective of this project was to implement and evaluate a clinical service that will provide counseling and multi-dose medication dispensing for patients with COPD admitted to the hospital. The specific aims of the project were:

1. To evaluate patient discharge fill compliance before and after implementation of a clinical pharmacy service to provide patient counseling and multi-dose medication dispensing to hospitalized patients with COPD
2. To evaluate 30-day readmission rates before and after implementation of a clinical pharmacy service to provide patient counseling and multi-dose medication dispensing to hospitalized patients with COPD
3. To assess possible cost savings due to decreased use of hospital resources before and after implementation of a clinical pharmacy service to provide patient counseling and multi-dose medication dispensing to hospitalized patients with COPD

Methods

Project setting

Harris Health System is a community-owned, fully integrated healthcare system comprised of two acute care hospitals, one rehabilitation/geriatric hospital, 16 community health centers, seven school based clinics, a dental center and a dialysis center. It offers an array of primary care, specialty care and acute care to all residents of Harris County, Texas. The facilities associated with the study include the following:

1. Ben Taub General Hospital is a 586 licensed bed academic teaching hospital within the Texas Medical Center. It is a Level I trauma center, which cares for more than 100,000 emergency patients visits each year. The hospital is staffed by physician faculty and residents of Baylor College of Medicine.
2. Lyndon B. Johnson General Hospital (LBJ) is a 328 licensed-bed academic teaching hospital offering a full range of medical services. LBJ Hospital is a busy Level III trauma center, with more than 70,000 emergency patient visits each year. The Hospital is staffed by physician faculty and residents of The University of Texas Health Science Center at Houston.
3. Harris Health System operates 16 outpatient pharmacies located at Ben Taub General and LBJ hospitals, 13 community health centers and a specialty infusion center. The pharmacy locations are strategically located throughout Harris County, Texas. These widespread pharmacies give patients access to fill their medications at a location near their home.

General study overview

This was a quasi-experimental before-after study. The first phase involved creation and implementation of a new clinical pharmacy initiative at the Harris Health System.

Patients with COPD on included study multi-dose medications were prospectively identified. Clinical pharmacists responsible for these patients provided the patient with their COPD-related multi-dose medications used during their inpatient stay, along with appropriate medication counseling. Post-discharge fill compliance and 30-day readmission rates were compared before and after implementation of the program. Additionally, the costs of waste disposal charges were compared before and after implementation of the clinical service, and product and labor cost savings were calculated. The study received exempt status by The University of Houston Institutional Review Board and administrative approval by Harris Health System.

Targeted multidose medications

The targeted medications in this study included budesonide/formoterol 160/4.5 mcg and 80/4.5 mcg, as well as fluticasone propionate/salmeterol 250/50 mcg and 500/50 mcg. These medications were available as brand name only and relatively expensive. They were not available on $4 lists at retail pharmacies. Therefore, patients were highly likely to use Harris Health System pharmacies to fill their medications, especially in the setting of its large indigent population. All other multidose medications were excluded from this evaluation.

Patient identification and intervention

Potential patients who were on the study's targeted medications were identified daily via a patient list which was developed within Harris Health's comprehensive electronic medical record system (figure 1). Clinical pharmacists would review the lists for each institution daily. The pharmacists would first identify new patients to the list and determine if they were a COPD patient who would qualify for the discharge initiative. Next, the pharmacist would review the electronic medical record (EMR) notes for insight into the

patient's current status and anticipated discharge date. The pharmacist also had the option of paging the responsible medical team, or calling the patent's nurse to also determine an estimated discharge date. To avoid missing patients who may be discharged after the pharmacist reviewed the list for the day, an available function was added to the list which included a "discharge" column (figure 1). When the physician had initiated the discharge process, an icon resembling a suitcase would appear. The pharmacist would check the list every 1-2 hours to see if the icon was present. If the icon was present, the pharmacist knew the patient was being discharged and could begin the MMDD discharge process.

The final step of the process involved the pharmacist verifying that the patient would be continuing the medication after discharge. This was done by checking for a discharge order with the same medication, dose and frequency, or checking the physician's discharge medication reconciliation documentation and observing that the physician indicated the patient is to continue the medication after discharge. The pharmacist could then dispense the medication and provide counseling to the patient. The pharmacist would generate an outpatient label using Harris Health's modified downtime outpatient label document. The pharmacist would then go to the patient's unit; retrieve the medication from the patient's bin; relabel the medication and provide appropriate counseling. Pharmacists provided general disease information; what the patient should do if their symptoms worsen; proper usage of the medication; and the importance of compliance with the medication. Documentation of patient education and dispensing of the multidose medication was recorded in a patient education section of the EMR.

Identification of historical controls

An 18-month baseline electronic report was generated from Harris Health System Information Technology Department for all patients hospitalized from April 2011 thru

October 2012 with an encounter diagnosis of COPD, and who had received at least one dose of the study multidose medications as an inpatient. The report generated 1266 patients, of which 412 were randomly selected. These patients are the non-interventional control group.

Data Analysis and statistical methods

Patient data was coded and stored in Excel spreadsheets. Stata/IC 12 was used for all statistical analyses.

Analysis for specific aim #1: To evaluate patient discharge fill compliance before and after implementation of a clinical pharmacy service to provide patient counseling and multi-dose medication dispensing to hospitalized patients with COPD.

For the control group, discharge first fill compliance was defined as filling the MMDD medication within three days of discharge. If the patient had at least a seven day supply of the medication remaining (according to pharmacy records), then they were also considered compliant in this measure. All patients in the intervention group were considered compliant in this measure. Patients who were determined to have Medicare or Medicaid coverage and no specific Harris Health plan coverage were excluded from this analysis, regardless of whether or not they used Harris Health pharmacies to fill their prescriptions. The reason for this exclusion was due to the fact that those patients have the option to use their prescription benefit coverage at pharmacies outside of Harris Health System, and there is no ability to capture data on whether or not the patients filled the medication at any outside pharmacy. For the analysis, the proportion of patients compliant with the discharge first fill of their multi-dose medications was compared between the intervention and historical non-interventional cohort using records from the outpatient pharmacy computer system. Differences in proportions were compared using the Pearson Chi-square analysis.

Additionally, a subgroup analysis was performed on patients in the pre-intervention group to determine if a difference in readmissions existed between patients who were compliant and noncompliant with this discharge fill compliance measure.

Analysis for specific aim #2: To evaluate 30-day readmission rates before, and after implementation of a clinical pharmacy service to provide patient counseling and multi-dose medication dispensing to hospitalized patients with COPD.

For this analysis, the proportion of patients readmitted to the hospital for any cause within 30 days was compared between the intervention group and the historical non-intervention group. Data on readmissions was obtained from hospital data systems. Pearson Chi square was used to compare proportions similar to the analysis plan for specific aim #1.

Analysis for specific aim #3: To assess cost savings due to decreased use of hospital resources before and after implementation of a clinical pharmacy service to provide patient counseling and multi-dose medication dispensing to hospitalized patients with COPD.

For this analysis, the disposal, dispensing labor, and medication product cost was multiplied by total amount of medications dispensed at discharge to calculate actual cost savings. Average length of stay for the intervention group was calculated to determine the average amount of days of medication remaining in the inhaler dispensed on discharge. At the time of this evaluation, Harris Health System was using a 15-day hospital pack inhaler for both study medications. This amount was multiplied by the number of dispensed inhalers to get a total full inhaler quantity. The subsequent number was then multiplied by average cost of the inhalers, as well as the average labor cost to dispense one inhaler.

Results

Data was collected on 412 patients from the pre-interventional historical control group and 54 patients underwent the clinical intervention to make up the intervention group. Table 1 lists all demographic information. There were no statistical differences between the groups on any measure. African Americans comprised the largest racial category for both groups, with 47.1% and 44.4% respectively. This was followed by Caucasians, Hispanics, and a small proportion of Asians. The comorbid presence of diabetes trended toward statistical difference ($p=0.08$), with a larger proportion in the pre-intervention group.

Discharge fill compliance

After excluding Medicare and Medicaid patients, 116 out of 247 patients in the pre-intervention group were compliant on the measure of discharge fill compliance for a rate of 47%, versus 36 out of 36 in the intervention arm for a rate of 100% (figure 2). This was a statistically significant difference between the groups ($p<0.001$).

A subgroup analysis was performed to determine if a larger proportion of noncompliant patients in the pre-intervention group were readmitted versus compliant patients. A total of 28 out of 131 patients who were noncompliant were readmitted. Twenty one of 116 compliant patients were also readmitted. There was no difference observed between these groups from the pre-interventional arm ($p=0.63$).

30-day readmissions

Eighty-eight out of 412 patients included from the pre-intervention group were readmitted within 30 days of the original admission for an effective rate of 21.4% (Figure 3). In the post-intervention group, four out of 54 patients were readmitted for a rate of 7.4% and a relative reduction of 65.4% ($p<0.05$).

Cost Savings

The average length of stay for the intervention group was calculated as 6 days, which left an average of 9 days of medication to be dispensed to the patient. After compiling an aggregate from all inhalers dispensed as part of the clinical service, it was determined that 32.4 inhalers were dispensed totaling a product cost savings of $2420 that was saved in the dispensing of outpatient prescriptions. Labor costs avoided due to the MMDD service were calculated to be approximately $5.88 per prescription, which resulted in a cost savings of $181. Disposal cost savings were estimated to be $210. The total cost savings from the MMDD dispensing of 54 inhalers was $2,811.

Discussion

The implementation of a targeted MMDD program was associated with a 64.5% relative reduction in 30-day hospital readmissions and a 53% relative increase in discharge fill compliance, as defined by this study. Cost savings were modest at $2811, but this may have been due to a limited sample size. These results support the hypothesis that using a very specific targeted approach can improve outcomes in patients. Since this study involved COPD patients, there are large potential positive implications for hospitals and health systems across the United States. If other institutions are able to successfully implement such a program, they can not only save money on the high cost of COPD readmissions, but can also avoid a cut in their reimbursement from exceeding their actual to expected admissions under the Readmissions Reduction Program.

In addition to a reduction in readmissions, it was hypothesized that dispensing the inhaler on discharge with pharmacist education would cause a patient to know the importance of taking their medication and actually experiencing the benefit and thus cause patients to be compliant with subsequent medication fills. Out of the 38 patients (Medicare and Medicaid were excluded) in the intervention group, 25 out of 38 (65.7%) were compliant with the first subsequent medication fill (defined as filling the medication within 14 days of anticipated fill date based on pharmacy records). Subsequent medication fill was not measured in the pre-intervention group, and this is one of the limitations of this study.

This study did conclude that MMDD programs are not easily implemented and must take into account resources and regulations. The amount of effort needed for such a program like the one in this study is great and requires maximization of informatics resources and coordination across healthcare professionals. Programs like these are likely best developed in ways, and having specific targets which are shown to improve patient outcomes or

generate significant cost savings. Other disease states which may benefit from this type of program are Asthma and Diabetes; and MMDD research should be pursued in these areas.

This study had both strengths and limitations. Since Harris Health System is essentially a closed system with a large self-pay population, many patients will seek all of their care from its facilities. However, it is possible that patients may have been readmitted in other facilities, and we therefore would have missed those readmissions. For those patients who are self-pay, Harris Health System pharmacies offer a much reduced payment for the study medications and therefore the discharge compliance analysis likely gave an accurate picture of patient compliance. A noteworthy limitation of the study was that we did not measure severity of the patient's COPD, though according to the GOLD guidelines, we might expect patients treated with the study combination inhaled medications would fit into the C and D severity categories. Those with less severe disease are less likely to have any exacerbations resulting in a hospital admission or readmission. Although statistical significance was achieved, sample size in the intervention group is a limitation. A larger sample size would have been able to give stronger support of this study's findings. Lastly, there was no method to measure if the patients actually took their medication after receiving it. A patient simply having the medication present does not independently signify compliance. Overall, this MMDD program was able to show positive outcomes and its implementation with a targeted approach is a viable area for expanded research on other chronic diseases which utilize multidose container medications.

Appendix

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Tables and Figures

Figure 1. Electronic medical record patient list with discharge indicator column

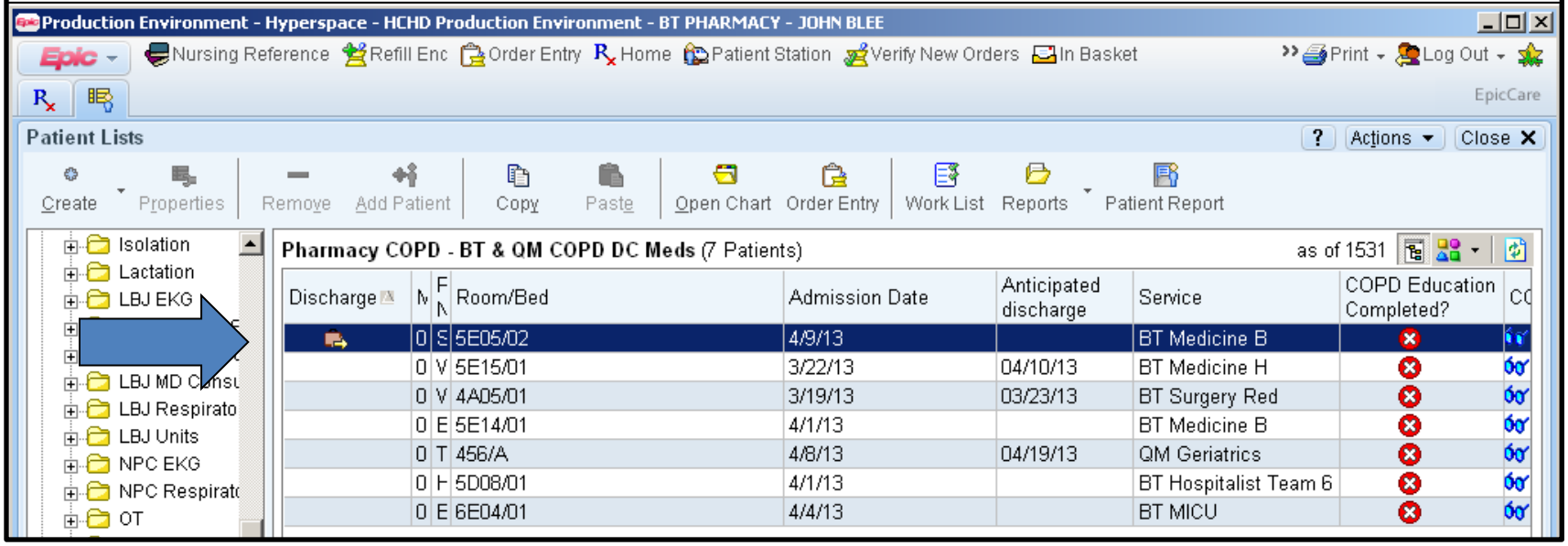

Table 1. Patient demographics

	Pre-intervention group	Post-intervention group	p value
Sex - no. (%)			0.19
Male	235 (57)	23 (42.6)	
Female	177(43)	31 (57.4)	
Age - mean SD	62.3 10.3	59.7 12.1	0.1
Race – no. (%)			0.78
African American	194 (47.1)	24 (44.4)	
Caucasian	135 (32.8)	18 (33.3)	
Hispanic	73 (17.7)	9 (16.7)	
Asian	9 (2.2)	3 (5.6)	
Smoker - no. (%)	141 (34.2)	25 (46.3)	0.2
Comorbidities - no. (%)			
CHF	129 (31.3)	11 (20.4)	0.1
Diabetes	153 (37.1)	10 (18.5)	0.06
Study Medication - no. (%)			0.08
budesonide/formoterol	311 (75.5)	48 (88.9)	
fluticasone/salmeterol	101 (24.5)	6 (11.1)	
Number of prescriptions at discharge - mean SD	6.8 4.8	6.1 3.1	0.3

Table 2. Calculated cost savings

Category	Measure	Estimated Cost Savings
Calculated aggregate number of complete inhalers dispensed on discharge	32.4 inhalers	$2420
Prescription average labor cost	$5.58/unit	$181
Estimated disposal cost savings	Per container	$210
Total cost savings		$2811

Figure 2. Discharge first fill compliance

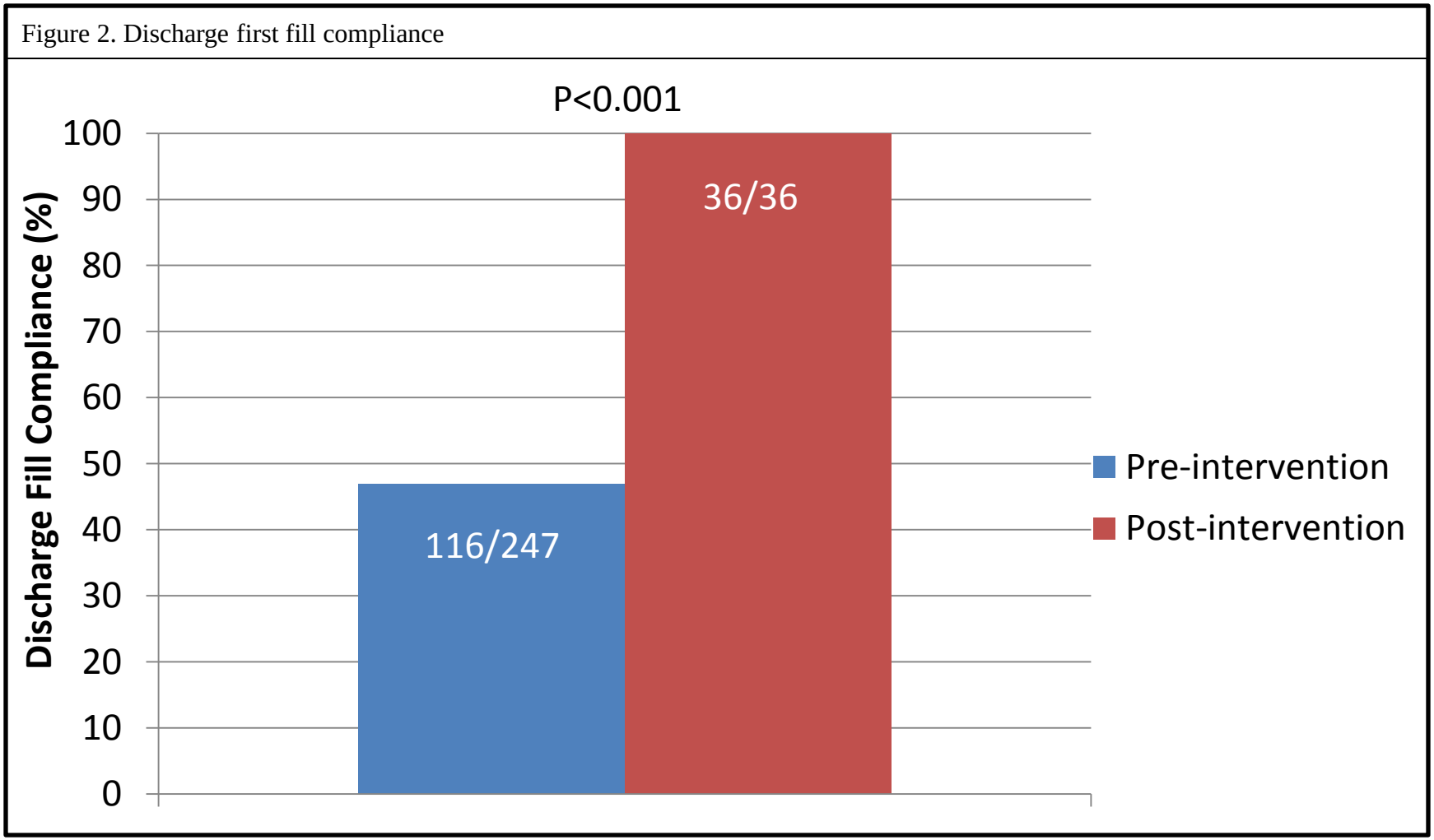

Figure 3. 30-day readmission rate