Adherence to a Bronchiolitis Clinical Pathway is Associated with Decreased Length of Stay and Costs

Mersine A. Bryan

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Rita Mangione-Smith

Megan Moreno

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Abstract

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Decreased Length of Stay and Costs

Mersine Bryan

Chair of the Supervisory Committee:
Rita Mangione-Smith, MD, MPH
Professor, Department of Pediatrics

Importance: Bronchiolitis is the leading cause of infant hospitalization in the United States. Bronchiolitis clinical pathway implementation may result in more efficient, higher value care.

Objective: To examine associations between level of adherence to bronchiolitis clinical pathway recommendations, healthcare utilization and costs.

Design: Retrospective cohort study

Participants: 267 patients 0-24 months diagnosed with bronchiolitis

Setting: A free-standing academic children's hospital emergency department (ED) and inpatient setting from 12/2009 to 7/2012.

Exposure: Clinical pathway adherence was assessed using a standardized scoring system (0-100 scale) for 18 process of care quality measures (6 ED; 12 inpatient) obtained by medical record review. Adherence scores were categorized into low, middle, and high tertiles.

Outcomes and Measures: Generalized linear models were used to examine relationships between adherence score tertile and 1) ED and inpatient length of stay (LOS), and 2) costs adjusted for LOS. Logistic regression was used to examine associations between adherence score tertile and 1) need for inpatient admission and 2) ED/inpatient 7-day readmissions. Models were adjusted for age, medical complexity and ED triage acuity.

Results: Mean adherence scores were: ED 78.8 (standard deviation [SD] 18.1, n=264), inpatient 95.0 (SD 6.3, n= 216), and combined ED and inpatient 88.6 (SD 9.2, n=267). ED and inpatient LOS were significantly shorter for cases in the highest versus the lowest adherence score tertile (**ED**: 190 minutes [SD 77] vs 264 minutes [SD 84], p<.001; and **inpatient:** 2.7 days [SD 1.7] vs 3.6 days [SD 3.0], p<.05). Both ED and inpatient costs were less for cases in the highest versus lowest adherence score tertile (**ED**: -$97, [95% confidence interval [CI] -$20, -$174; p < .05]; and **inpatient**: -$1,601 [95% CI -$292, -$2,910; p <.05]). ED cases in the highest tertile had a lower odds of inpatient admission versus cases in the lowest tertile (OR 0.38 [95% CI .15, .97]). Readmissions and ED return visits did not differ by adherence score tertile.

Conclusions: High adherence to bronchiolitis clinical pathway recommendations was associated with shorter LOS and lower cost. These reductions did not result in increased readmissions or return ED visits. Using evidence-based standards may reduce unnecessary healthcare utilization.

Introduction

Bronchiolitis is the leading cause of infant hospitalization and is associated with direct medical costs exceeding 500 million dollars annually in the United States.[1] The cost from bronchiolitis hospitalizations is increasing.[1-4] Hospital-based care of bronchiolitis is primarily supportive. Evidence suggests that additional testing, such as obtaining chest x-rays or viral respiratory panels, is unnecessary and that multiple therapies including bronchodilators, corticosteroids, and antibiotics do not improve outcomes.[2,5-10] Consequently, many hospitals have implemented clinical practice guidelines (CPGs) and clinical pathways to decrease variability in care and unnecessary use of interventions as a mechanism to decrease costs.

Many prior studies have examined the effectiveness of CPGs and clinical pathways on inpatient bronchiolitis processes of care[11]. These studies have demonstrated mixed results with decreased use of some, but not all, unnecessary interventions.[12-16] While there appears to be a reduction in resource utilization for bronchiolitis from CPGs and clinical pathways within institutions, there continues to be wide variation in practice for inpatient bronchiolitis care across institutions.[1,11,17,18]

Because the presence of a CPG does not unequivocally predict better inpatient care, a more precise understanding of how CPG and clinical pathway implementation influences clinician behavior is needed. Studies to date have not compared the impact of adherence to specific processes of care within the pathway on healthcare outcomes, limiting our understanding of how extensively these pathways are implemented and applied to each individual patient. Therefore, our objective was to evaluate the impact of adherence to standardized clinical processes of care for bronchiolitis on healthcare utilization and costs in the pediatric emergency department (ED) and inpatient settings.

Methods

Study Population

We conducted a retrospective analysis of 267 patients admitted with an exclusive discharge diagnosis of bronchiolitis to Seattle Children's Hospital (SCH), a free-standing academic children's hospital that serves as a referral center for five states, from December 1, 2009 to July 31, 2012. Cases were identified from the Pediatric Hospital Information System (PHIS) database using the International Classification of Diseases, 9th edition (ICD-9) Clinical Modification codes for bronchiolitis (466.1x). Fifty-one cases were seen in the ED only and not admitted. Three cases were directly admitted to the inpatient setting only and not seen in the ED. The remaining 213 cases were treated in both the ED and inpatient settings. Patients' ages ranged from 0 months to 24 months. Cases were excluded if they had cardiac disease requiring baseline medication, anatomic airway abnormalities, reactive airway disease or asthma at greater than 12 months of age, cystic fibrosis, neuromuscular disease, bronchopulmonary dysplasia, immunodeficiency or chronic lung disease. We used both ICD-9 CM codes and chart review to ensure subjects did not have any of the excluded diagnoses. We only included cases that had an exclusive discharge diagnosis of bronchiolitis to ensure a relatively healthy sample of children with bronchiolitis. To be included in the study, cases did not need to have the clinical pathway electronic orderset activated. The SCH institutional review board approved this study.

Determining Level of Adherence to Bronchiolitis Clinical Pathway

The level of adherence to the bronchiolitis clinical pathway was determined using the Pediatric Respiratory Illness Measurement System (PRIMES) quality indicators developed by Mangione-Smith et al. (manuscript under review). PRIMES is a set of process of care quality indicators that can be used to assess the clinical management of pediatric respiratory conditions including bronchiolitis. PRIMES was developed based on a review of current literature and

clinical practice guidelines, and validated using the RAND- University of California, Los Angeles (UCLA) modified Delphi method.[19] Detailed measure specifications were created for each quality indicator and used in the development of a standardized electronic medical record abstraction and scoring tool.

We first identified PRIMES quality indicators that corresponded to specific processes of care in the SCH bronchiolitis clinical pathway. This process was done in a collaborative and iterative manner by the authors, one of whom was the physician leader involved in developing the bronchiolitis clinical pathway, and the medical record abstractors. Of the 21 PRIMES indicators, 18 that corresponded with clinical pathway care recommendations were included (eTable 1). Of the three indicators that were not included in this study, two were excluded because there was no pathway recommendation that corresponded to the PRIMES indicator. The third indicator that was excluded regarded the use of chest x-rays. The pathway and PRIMES recommendations were in agreement that chest x-rays should not routinely be done in bronchiolitis patients, however the exception criteria of when to get a chest x-ray differed between the pathway and PRIMES. Therefore determining adherence to the PRIMES indicator for when to get a chest x-ray did not reflect adherence to the SCH clinical pathway, and thus we did not include it in this study.

The PRIMES indicators are intended for use either in the ED or inpatient setting. Six of the included indicators used in this study applied to the ED setting and 12 applied to the inpatient setting. For each case in our sample, two trained research nurses performed medical record abstractions using the PRIMES tool to determine if the patient met eligibility criteria for each PRIMES bronchiolitis indicator (denominator) and whether the patient received the indicated care (numerator). There was high interrater reliability between the 2 medical record abstractors with a kappa of 0.9 for determination of indicator eligibility and 0.8 for determining receipt of indicated care. Level of adherence to the clinical pathway was determined by

computing three scores for each case: 1) an ED quality indicator adherence score, which was calculated as the number of indicators met divided by the number they were eligible for across the six ED quality indicators; 2) an inpatient adherence score, which was calculated as the number of indicators met divided by the number they were eligible for of the 12 inpatient quality indicators; and 3) a combined ED and inpatient adherence score, which was calculated as the number of indicators met divided by the number they were eligible for across all 18 quality indicators. Scores were standardized on a 0-100 scale, with higher scores reflecting better adherence to the pathway.

Outcomes

We examined the association between level of adherence to the bronchiolitis clinical pathway and the following outcomes: ED and inpatient length of stay (LOS), ED and inpatient costs, inpatient admission from the ED, 7 day return ED visits and 7 day readmissions to the hospital. Charges for each case, which included pharmacy, lab, and room and board, were obtained from hospital administrative records. Charges were converted to costs using institutional cost-to-charge ratios based on the fiscal year of admission. Specific costs for ED care, radiology, pharmacy, and laboratory were calculated using department-specific institutional cost-to-charge ratios by fiscal year. All costs were inflation adjusted to 2014 dollars using the medical care services component of the Consumer Price Index.[20]

Statistical Analysis

We aimed to compare differences in healthcare utilization and cost for varying levels of pathway adherence. We divided cases into tertiles based on their ED and combined ED and inpatient adherence summary scores and compared cases in the lowest tertile to those in the highest tertile. Multivariate generalized linear models were used to determine the association between ED adherence score tertile and ED LOS and ED cost as continuous variables.

Multivariate generalized linear models were also used to determine the association between the ED and inpatient combined adherence score tertile and inpatient LOS and cost as continuous variables. Models for the ED LOS and costs analyses were adjusted for age, triage acuity, and medical complexity, and whether or not cases were admitted to the inpatient setting. The inpatient cost model was additionally adjusted for inpatient LOS which was dichotomized into $\leq$ 3 days and > 3 days. LOS and cost variables were truncated at the 99th percentile to prevent the skewed distribution from distorting standard errors in the multivariate analyses. Observations above the 99th percentile were assigned the value of the 99th percentile; this occurred for 3 LOS and 3 cost observations. Models utilized an X family and an X link as is typical of analyses of utilization data; the appropriate family was chosen using the Modified Park test.[21] Multivariate logistic regression models were used to determine the association between the ED adherence score tertile and the dichotomous variables of 7 day ED return visits and inpatient readmission, adjusting for age, triage acuity and medical complexity. Multivariate logistic regression was also used to determine the association between the combined ED and inpatient adherence score tertile and the dichotomous 7-day readmission variable, adjusting for age and medical complexity. We did not examine inpatient adherence scores independently in the models due to lack of variability in adherence scores between the tertiles.

Covariates

The following variables were included as covariates: age, medical complexity, ED triage acuity and, for ED outcomes, whether or not the case was admitted to the inpatient setting. Medical complexity was assessed using the Pediatric Medical Complexity Algorithm (PMCA). [22] This algorithm classifies children into three categories: without chronic disease, non-complex chronic disease and complex chronic disease based on hospital discharge administrative ICD-9 billing codes. ED triage acuity was assigned to each patient by a trained nurse on presentation to the ED as part of standard clinical practice with the following categories in decreasing level of

severity: Critical, Emergent, Urgent, Non-Urgent, Minor. These data were abstracted from the medical record. We conducted medical record review for all cases classified by PMCA as non-complex or complex chronic disease (N=49) to ensure they met eligibility criteria for the study.

Results

Demographics

Children in the highest adherence tertile had a significantly younger mean age compared to those in the lowest tertile (6.8 months versus 8.7 months; $p < 0.05$; Table 1). There were no significant differences in the distribution of gender, race/ethnicity, or medical complexity by adherence tertiles.

Adherence Summary Scores

Adherence scores by tertile are presented in Table 2. Adherence was highest for the inpatient quality indicators (mean score 95.0 [SD 6.3]). The lowest mean adherence scores were observed in the ED (mean score 78.8 [SD 18.1]).

Cost

The mean total costs for cases with combined ED and inpatient adherence scores in the highest tertile were significantly lower than the mean total cost for cases with adherence scores in the lowest tertile, adjusting for age, medical complexity and LOS (Table 3). The mean ED costs for cases with ED adherence scores in the highest tertile were significantly lower than for those cases with scores in the lowest tertile, adjusting for age, triage acuity, medical complexity and whether or not the case was admitted for inpatient hospitalization (Table 3). We found significantly lower costs resulting from laboratory and radiographic studies for cases with combined ED and inpatient adherence scores in the highest compared to the lowest tertile, but

no significant differences in pharmacy costs with all models adjusted for age, medical complexity and LOS. (Table 3)

Length of Stay

The mean ED LOS was significantly shorter for cases with ED adherence scores in the highest versus the lowest tertile adjusting for age, triage acuity, medical complexity and whether or not the case was admitted for inpatient hospitalization (Table 3). The mean inpatient LOS was approximately one day shorter for cases with combined ED and inpatient adherence scores in the highest compared to the lowest tertile adjusted for age, medical complexity and triage acuity(Table 3).

Inpatient admission, seven-day ED revisits and repeat admissions

Cases with ED adherence scores in the highest tertile had a lower odds of inpatient admission compared to those in with scores in the lowest tertile when adjusted for age, triage acuity and medical complexity (OR 0.38 [95% CI 0.15, 0.97]). Only five cases had a 7 day return ED visit and only six had an inpatient readmission. There were no significant differences in the frequency of repeat ED visits or readmissions by adherence score tertile after adjusting for age and medical complexity.

Discussion

In this retrospective cohort of otherwise healthy children with bronchiolitis, we examined the association between adherence to an evidence-based bronchiolitis clinical pathway and healthcare utilization outcomes and cost. Overall, we found shorter LOS and lower costs in cases with higher adherence to the bronchiolitis clinical pathway in both the ED and inpatient settings. There was a lower odds of inpatient admission for cases with high adherence to the

ED pathway processes of care. In spite of shorter LOS and lower risk of admission, there was no difference in the odds of return ED visits or inpatient readmission within 7 days of discharge.

Overall there was high adherence to pathway care processes in our study. However, as demonstrated in previous studies, in spite of the presence of a clinical pathway, there remains variation in care for bronchiolitis.[11] The variability in adherence was more prevalent in the ED compared to the inpatient setting. This difference is likely due to more diagnostic uncertainty present in the ED compared to after admission. The majority of previous studies looking at implementation of clinical pathways and CPGs have focused on the inpatient setting.[1,11,13,14,17,23] While the benefits of costs and time saved by higher adherence to the ED pathway care processes are more modest per case than those for admitted patients, because the volume of ED bronchiolitis cases is large, there remains an important opportunity for improved quality of care and healthcare utilization through high adherence to evidence-based care processes in the ED.[3]

Previous studies have focused on decreasing resource utilization in the management of bronchiolitis, but few have demonstrated differences in cost as a result.[4,13,14,24-26] Our study demonstrated that when the care team adhered to evidence-based processes of care within the clinical pathway, cases had lower ED and inpatient hospitalization costs, by 11% and 23% respectively, after adjusting for age, medical complexity, triage acuity and LOS. Specifically we found that adherence to pathway care processes was associated with lower costs related to radiographic and laboratory testing, although this only accounted for some of the difference in cost between the low and high adherence score tertiles.

Studies examining the success of clinical pathway or CPG implementation have generally focused on process measures including activation of ordersets and use of medical treatments and therapies.[11,26] Studies assessing use of specific therapies after implementation

of clinical pathways and CPGs demonstrate reductions in use of some interventions, but no impact on others; which interventions are specifically reduced by quality improvement efforts is variable between studies.[11,12,14] A recent study by Mittal et al. compared institutions with CPGs to those without CPGs and found no overall decrease in the ordering of tests and treatments across institutions in spite of consensus amongst CPGs recommending against these interventions.[11] Our study demonstrates the importance of using more refined measures of adherence to fully understand whether clinical pathways and CPGs are being implemented as intended and that doing so in both the ED and inpatient settings, can lead to measurable differences in healthcare utilization and cost. As significant variability in the care of children with bronchiolitis still exists across hospitals nationally, institutions should consider incorporating routine assessment of adherence to evidence-based quality indicators to both guide ongoing quality improvement efforts and ultimately enhance healthcare utilization outcomes.[23] Implementation of tools like PRIMES that allow us to examine the association between the quality of care processes provided and healthcare utilization provides a mechanism to assess the value of the care we are providing.

Limitations

We collected data retrospectively using medical record review and were only able to account for care processes that were documented. As a result, we are unable to make any causal inferences between pathway adherence and healthcare utilization outcomes. Patient factors such as severity of illness may have influenced adherence to the clinical pathway. We attempted to take severity of illness into account by using an exclusive discharge diagnosis of bronchiolitis to minimize the inclusion of cases that had a concurrent suspected bacterial illness or other co-morbidities. We additionally adjusted for triage acuity, which we believe is reflective

of severity at initial presentation but may not be a sensitive marker of illness later during an admission.

Because we did not include the PRIMES indicator for chest x-ray in our analysis, there is uncertainty in how much the decreased costs related to radiographic testing contribute to the overall lower cost for cases in the high adherence score tertile.

We conducted a single center study based specifically on the Seattle Children's Hospital bronchiolitis clinical pathway which limits generalizability across institutions. Because we used evidence-based quality indicators for bronchiolitis care that were present in the Seattle Children's clinical pathway as markers for adherence, we expect that clinical pathways and CPGs at other institutions which include evidence-based practices would yield similar results.

Conclusions

Our study illustrates the importance of clinician adherence to specific pathway care processes, which is variable despite the presence of a robust clinical pathway. In a time where costs from bronchiolitis hospitalizations have been increasing, we demonstrated that adherence to evidence-based recommendations within a clinical pathway is associated with lower cost of hospitalizations and ED visits. By providing higher quality of care for bronchiolitis at a lower cost and with shorter LOS, we demonstrated the ability to provide higher value care through adherence to evidence-based recommendations within a clinical pathway. Adhering to evidence-based standards of practice in the care of bronchiolitis in both the ED and inpatient settings has the potential to substantially reduce unnecessary healthcare service use.

Table 1: Comparison of Pediatric Respiratory Illness Measurement System (PRIMES) quality indicators and pathway recommendations to determine inclusion of indicators in the evaluation of adherence to the bronchiolitis pathway

PRIMES Quality Indicators	Pathway Recommendation	Included?
Emergency Department		
All patients with a diagnosis of bronchiolitis should have the presence or absence of risk factors for severe disease documented: History of prematurity, low birth weight, and underlying cardiopulmonary disease	None	No. There are no history taking recommendations or requirements within the pathway
Patients diagnosed with bronchiolitis should have the presence or absence of the following physical exam findings: Signs of respiratory illness (respiratory rate, presence or absence of: wheezing, retractions or color change, signs of dehydration)	Patients should have an assessment and respiratory score within 30 minutes of arrival and pretreatment. Respiratory score includes: respiratory rate, wheezing, retractions, color change and dyspnea.	Yes
All otherwise healthy children older than 8 weeks diagnosed with bronchiolitis should not have bacterial blood cultures performed.	Evidence does not support routine ordering of labs or radiologic studies.	Yes
All otherwise healthy children older than 8 weeks diagnosed with bronchiolitis should not have blood gas tests performed unless there is evidence of severe respiratory distress or impending respiratory failure.	Evidence does not support routine ordering of labs or radiologic studies.	Yes
All otherwise healthy children older than 8 weeks diagnosed with bronchiolitis should not have a complete blood count performed.	Evidence does not support routine ordering of labs or radiologic studies.	Yes

PRIMES Quality Indicators	Pathway Recommendation	Included?
All otherwise healthy children older than 8 weeks diagnosed with bronchiolitis should not have a test for RSV performed.	Routine viral testing for pathogens is not recommended.	Yes
All otherwise healthy children older than 8 weeks diagnosed with bronchiolitis should not have a chest radiograph performed. Exceptions when a chest radiograph should be considered include: known exposure to pneumonia, Group B Strep positive mother not treated at delivery or with fever, rales/crackles on lung auscultation.	Evidence does not support the routine use of chest radiographs in bronchiolitis. Exceptions when a chest radiograph should be considered include: fever for longer than 2 days, an asymmetric chest exam, does not demonstrate improvement after suctioning, or has unusually high oxygen need.	No. While neither the PRIMES indicator nor the pathway recommend routine use of chest radiographs, the exception criteria are different. A patient could fail the PRIMES indicator but still be adherent to pathway recommendations.
Patients diagnosed with bronchiolitis in the ED who are noted to be feeding well and have no more than mild respiratory symptoms and signs should be discharged home.	Patients with a respiratory score less than 8 with no risk factors should be discharged.	Yes
Inpatient		
Hospitalized children with a diagnosis of bronchiolitis should not be treated with bronchodilators unless a carefully monitored bronchodilator trial is documented showing benefit.	Bronchodilators should only be tried if patient has risk factors for reactive airway disease: strong family history of atopy or asthma, history of recurrent wheezing, or history of recurrent wheeze. Respiratory scoring should be done before and after albuterol trial. Albuterol should only be continued if respiratory score improves after albuterol by 2 or more points.	Yes
Hospitalized children with a diagnosis of bronchiolitis should not be treated with ribavirin.	Other medications have no proven benefit.	Yes

PRIMES Quality Indicators	Pathway Recommendation	Included?
Hospitalized children with a diagnosis of bronchiolitis should not be treated with antibiotics unless the child is also diagnosed with a possible bacterial infection.	Antibiotics not routinely recommended.	Yes
Hospitalized children with a diagnosis of bronchiolitis should not be treated with corticosteroids.	Corticosteroids not routinely recommended.	Yes
Hospitalized children with a diagnosis of bronchiolitis should not be treated with chest physiotherapy.	Chest physiotherapy not routinely recommended.	Yes
If a child admitted to the hospital with a diagnosis of bronchiolitis has difficulty feeding safely because of respiratory distress, then he or she should receive supplemental fluids.	IV fluids should be considered if the patient is not eating, is not allowed to eat due to respiratory distress, has poor urine output or has other signs and symptoms of dehydration.	Yes
Hospitalized children with a diagnosis of bronchiolitis should not be treated with antihistamines, oral decongestants, or nasal vasoconstrictors.	Other medications have no proven benefit.	Yes
Hospitalized children with a diagnosis of bronchiolitis should not be treated with cool mist therapy.	Other therapies not routinely recommended.	Yes
Hospitalized children with a diagnosis of bronchiolitis should undergo repeated clinical assessments at a minimum of every 4 hours during the first 48 hours of admission.	Vital signs and respiratory scoring should be done at a minimum of every 4 hours.	Yes
Children admitted to the hospital with bronchiolitis should have the following discharge criteria documented on the day of discharge: reduced work of breathing.	Patients should have a documented respiratory score less than 5 for 12 hours prior to discharge.	Yes

PRIMES Quality Indicators	Pathway Recommendation	Included?
Children admitted to the hospital with bronchiolitis should have the following discharge criteria documented on the day of discharge: on room air.	Discharge criteria include being off oxygen for 12 hours prior to discharge and maintaining oxygen saturations greater than 88% while asleep and 90% while awake.	Yes
Children admitted to the hospital with bronchiolitis should have the following discharge criteria documented on the day of discharge: on feedings at a level to prevent dehydration.	Discharge criteria include feeding adequately.	Yes
Parents with children admitted to the hospital with bronchiolitis should be instructed to schedule a follow up appointment with he child's primary care provider within 1 week of discharge.	None	No. There is a hospital wide recommendation to schedule follow up for patients prior to discharge. However, there is no specific recommendation within the pathway.

Table 2: Patient Demographic Characteristics Overall and by Adherence Score Tertile

	All patients N= 267	**Highest Adherence Score Tertile N = 91**	**Lowest Adherence Score Tertile N = 87**
Mean age in months (standard deviation)[a]	7.8 (5.6)	6.8 (5.6)	8.7 (6)
Gender			
Female	43%	41%	41%
Male	57%	59%	59%
Race (%)			
White	48%	51%	43%
Black	9%	9%	13%
Hispanic	22%	21%	23%
Asian	8%	8%	7%
Other	13%	11%	14%
PMCA (%)[b]			
Non Chronic	81%	83%	80%
Non Complex Chronic	17%	16%	17%
Complex Chronic	2%	1%	2%

a. Significant difference between adherence categories; $p<0.05$

b. Pediatric Medical Complexity Algorithm[22]

Sums may not equal 100% due to rounding

Table 3: Mean Adherence Scores by Tertile

	All patients		Highest Adherence Score Tertile		Lowest Adherence Score Tertile	
	N[a]	Mean (SD)[b]	N	Mean (SD)	N	Mean (SD)
ED[c] scores	264	78.8 (18.1)	91	95.3 (4)	91	58.9 (15.6)
Inpatient scores	216	95.0 (6.3)	73	99.7(0.2)	69	87.2 (5.1)
Combined ED and Inpatient scores	267	88.6 (9.2)	91	97 (2)	87	77.9 (7.7)

a. Fifty-one cases were treated in the ED only; 3 cases were treated inpatient only. Combined scores include all cases.
b. SD = Standard Deviation
c. ED = Emergency Department

Table 4: Regression models of association between adherence score tertile, costs and length of stay (LOS) outcomes

Outcome	Adherence tertile	Unadjusted (95% CI*)	Unadjusted difference (95 % CI)	Adjusted (95% CI)	Adjusted difference (95% CI)
Total Cost	High	$6,442.73 (5,175.18, 7,710.28)	-$2,260.82 (-4,318.19, -738.49)	$5,220.22 (4,055.75, 6,384.69)	-$1,600.73 (-2,909.78, -291.69)[a]
	Low	$8703.55 (7,399.25, 10,007.85)		$6,820.95 (5,486.25, 8,155.65)	
ED Cost	High	$764.49 (682.26, 836.73)	-$117.35 (-222.27, -12.43)	$605.19 (481.53, 728.84)	-$97.04 (-173.65, -20.44)[b]
	Low	$977.58 (905.35, 1049.82)		$702.23 (571.75, 832.72)	
Lab Cost	High	$172.88 (127.80, 217.97)	-$104.89 (-169.73, -40.05)	$219.27 (161.12, 277.42)	-$107.32 (-172.70, -41.95)[a]
	Low	$260.08 (213.97, 306.19)		$326.60 (259.94, 393.25)	
Radiology Cost	High	$50.95 (26.80, 75.09)	-$59.48 (-94.21, -24.75)	$28.07 (58.74, -2.59)	-$58.12 (-96.29, -29.22)[a]
	Low	$111.29 (86.60, 135.99)		$86.20 (51.05, 121.35)	
Inpatient LOS (days)	High	2.7 (2.2, 3.2)	-1.0 (-1.7, -0.3)	3.5 (2.8, 4.2)	-0.9 (-1.5, -0.1)[c]
	Low	3.6 (3.1, 4.1)		4.4 (3.6, 5.1)	
ED LOS (minutes)	High	190 (173, 206)	-34 (-58, -10)	105 (70, 140)	-52 (-74, -30)[b]
	Low	264 (248, 281)		157 (120, 194)	

All costs are reported in 2014 dollars.

* CI= Confidence Interval

a. Adjusted for age, medical complexity, categorical length of stay
b. Adjusted for age, medical complexity, triage acuity, and whether or not the patient was admitted to the inpatient setting
c. Adjusted for age, medical complexity, and triage acuity

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