

# The Impact of Alvimopan on Hospital Cost After Bowel Resection: Results From a Large Inpatient Database

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## ABSTRACT

**Purpose:** Delayed gastrointestinal (GI) recovery after bowel resection is associated with increased length of stay (LOS) and cost. Alvimopan, a peripherally acting mu-opioid receptor antagonist, accelerates GI recovery after bowel resection. We undertook this study to evaluate the economic impact of alvimopan in clinical practice.

**Methods:** We conducted a retrospective matched cohort study using data from a large national hospital database. We identified adults who had small or large bowel resection with primary anastomosis, who were discharged between 01-01-2009 and 06-30-2009, and had surgery at a hospital where alvimopan was used at least once during the study period. We matched each alvimopan user to two untreated controls. The primary outcome of total hospital cost and secondary outcomes of cost components and length of stay (LOS) were compared between groups.

**Results:** The final study cohort included 480 alvimopan users and 960 matched controls. The mean total hospital cost was \$12,865 for alvimopan users, compared with \$13,905 for controls, a difference of \$1,040 ( $P=0.033$ ). Ileus-related, pharmacy and diagnostic radiology costs did not differ significantly. Mean hospital length of stay was 5.6 days among alvimopan users and 6.5 days among controls ( $P<.001$ ).

**Conclusions:** Alvimopan users had significantly lower total hospital costs and length of stay than controls. Along with other initiatives to improve quality and reduce costs of surgical care, alvimopan should be considered for use in the perioperative management of patients who undergo segmental bowel resection with primary anastomosis.

## INTRODUCTION

- Many recent health policy discussions focus on how to improve surgical quality and reduce costs<sup>1,2</sup>
- Delayed GI recovery is the most common cause of and a significant risk factor for increased LOS and cost<sup>3-6</sup>
- Alvimopan, a peripherally-acting mu-opioid receptor antagonist, was approved in 2008 for acceleration of GI recovery after bowel resection

## OBJECTIVES

- Compare total hospital cost in patients treated with alvimopan compared to matched controls in a clinical practice setting
- Evaluate between-group comparisons of hospital cost (e.g., ileus-related costs) and LOS

## STUDY DESIGN AND METHODS

- Retrospective matched cohort study
- Data from Premier Perspective™ Comparative Database

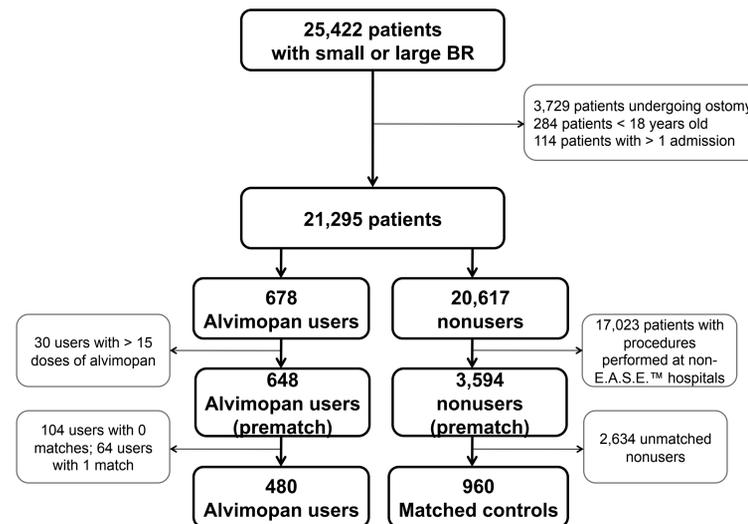
### Population

- Included
  - Patients ≥18 years with laparoscopic or open bowel resection and discharged between 1/1/2009 to 6/30/2009
- Excluded
  - Patients with a non- functioning anastomosis (i.e. diverting ostomy), or who used >15 doses of alvimopan (i.e., inconsistent with the product label), or had surgery at a hospital that did not have alvimopan use

### Baseline Variables and Outcomes

- Baseline variables
  - Patients demographics and clinical characteristics, physician and hospital characteristics

**Figure 1.** Identification of study patients.  
BR = Bowel resection; E.A.S.E. = Entereg Access Support and Education.



- Before matching, the groups differed significantly with regard to patient, procedure, hospital and physician characteristics
- No statistically significant differences between alvimopan users and controls after matching (Table 2)

- Outcomes
  - Primary study outcome: total hospital cost
    - Primary comparison: unadjusted mean cost for alvimopan users and matched controls
  - Secondary outcomes: LOS and pharmacy, radiology, and ileus-related costs
- Analysis
  - Patients grouped into alvimopan users and nonusers using pharmacy charges
  - Matched controls 2:1 with alvimopan users using a combination of propensity scores and exact matching
  - Propensity scores estimated with a logistic regression model incorporating most baseline measures as independent variables and alvimopan use as the dependent variable
  - Compared means of total hospital cost, components of cost, and LOS directly between the matched cohorts using *t* tests

## RESULTS

**Table 2. Characteristics of Matched Alvimopan Users and Matched Controls**

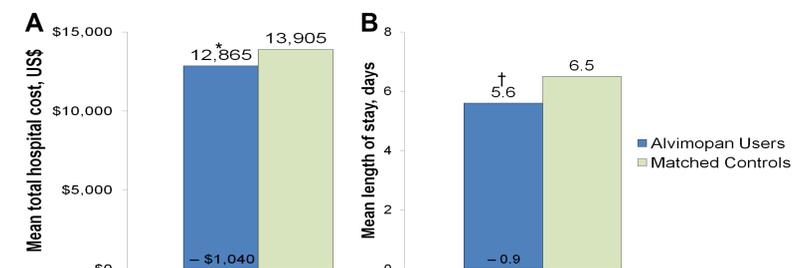
Variable	Alvimopan Users (n = 480; 33.3%)	Matched Controls (n = 960; 66.7%)	P Value
<b>Patient Characteristics</b>			
Age (y) (Mean, SD)	63.1 (14.0)	62.5 (14.0)	0.434
	No. (%)		
Age group			0.898
18-44	47 (9.8)	104 (10.8)	
45-64	206 (42.9)	414 (43.1)	
65-74	113 (23.5)	227 (23.6)	
75+	114 (23.8)	215 (22.4)	
Female	248 (51.7)	495 (51.6)	0.970
<b>Race/ethnicity</b>			0.797
White	330 (68.8)	676 (70.4)	
Black	40 (8.3)	78 (8.1)	
Other	110 (22.9)	206 (21.5)	
No. of chronic conditions (Mean, SD)	3.2 (1.7)	3.1 (1.7)	0.643
<b>Admission and Procedure Characteristics</b>			
<b>Index procedure type</b>			n/a
Laparoscopic colon and rectal	222 (46.3)	444 (46.3)	
Open colon and rectal	183 (38.1)	366 (38.1)	
Open small bowel	30 (6.3)	60 (6.3)	
Ostomy takedowns, bypasses, other	45 (9.4)	90 (9.4)	
No. of alvimopan doses (Mean, SD)	7.7 (3.8)	0	–
Operative time (min) (Mean, SD)	193.0 (81.4)	192.0 (91.6)	0.838
Red blood cell transfusion	17 (3.5)	29 (3.0)	0.596
<b>Diagnosis</b>			
Cancer of intestine	183 (38.1)	344 (35.8)	0.395
Inflammatory bowel disease	19 (4.0)	39 (4.1)	0.925
Diverticular disease	133 (27.7)	264 (27.5)	0.934
<b>Hospital and Physician Characteristics</b>			
<b>Hospital region</b>			n/a
Midwest	116 (24.2)	232 (24.2)	
Northeast	83 (17.3)	166 (17.3)	
South	269 (56.0)	538 (56.0)	
West	12 (2.5)	24 (2.5)	
<b>Location</b>			0.959
Rural	76 (15.8)	153 (15.9)	
Urban	404 (84.2)	807 (84.1)	
Teaching hospital	297 (61.9)	594 (61.9)	0.999
<b>Physician specialty</b>			0.719
General surgeon	328 (68.3)	652 (67.9)	
Colorectal surgeon	123 (25.6)	236 (24.6)	
Other	17 (3.5)	46 (4.8)	
Unknown	12 (2.5)	26 (2.7)	
<b>Bowel resection case volume</b>			0.114
Low case volume (1-11)	101 (21.0)	238 (24.8)	
High case volume (12+)	379 (79.0)	722 (75.2)	

Min = minutes; SD = standard deviation; y = years.

- Mean total hospital cost was \$12,865 for alvimopan users and \$13,905 for matched controls, a difference of \$1,040 ( $P = .033$ ; Figure 2A, Table 3)
- Mean LOS was 5.6 days for alvimopan users and 6.5 days for controls ( $P<.001$ ; Figure 2B, Table 3).
- Results did not change in a sensitivity analysis that used multivariate regression to control for residual differences between groups or in another analysis that stratified by case volume.

**Figure 2. Mean Total Hospital Cost (A) and LOS (B)**

\*  $P < 0.05$ ; †  $P < 0.001$ .



**Table 3. Cost and Utilization in Alvimopan Users and Matched Controls**

Variable	Alvimopan Users (n = 480; 33.3%)	Matched Controls (n = 960; 66.7%)	P Value
<b>Total hospital cost (\$)</b>			
Mean (SD)	12,865 (7,826)	13,905 (10,305)	0.033
95% CI	12,163-13,567	13,252-14,558	
Diagnostic radiology cost (\$)			
Mean (SD)	181 (445)	210 (492)	0.252
95% CI	141-220	179-241	
Total pharmacy cost (\$)			
Mean (SD)	1,431 (1,892)	1,331 (2,024)	0.369
95% CI	1,261-1,601	1,203-1,460	
Ileus-related cost* (\$)			
Mean (SD)	83 (286)	114 (400)	0.086
95% CI	57-109	89-140	
<b>Length of stay (d)</b>			
Mean (SD)	5.6 (4.1)	6.5 (4.6)	<0.001
95% CI	5.2-6.0	6.2-6.8	

\*Including the supply and labor costs of postoperative nasogastric tubes insertion, parenteral nutrition, and antiemetics/gastrointestinal stimulants (e.g., metoclopramide).

## DISCUSSION

- Patients treated with alvimopan had mean total hospital costs of \$1,040 less than a propensity score-matched control group, even after accounting for the cost of the medication
- Hospital stay was nearly a full day shorter among alvimopan users compared with controls
- The direction and magnitude of the cost savings and LOS reduction were similar to effects reported in clinical trials

## LIMITATIONS

- Hospital claims are generated for administrative, not clinical, purposes and may have errors and omissions
- No ICD-9-CM code for post operative ileus exists, possibly leading to under-counting of ileus-related cost across both cohorts
- Use of control patients only from hospitals with alvimopan use may limit the ability to broadly generalize results

## CONCLUSION

- Alvimopan users had lower total hospital costs and shorter length of stay than controls
- Along with other initiatives to improve quality and reduce costs of surgical care (accelerated care pathways, laparoscopy), alvimopan should be considered for use in the perioperative management of patients who undergo segmental bowel resection with primary anastomosis

## REFERENCES

- Gawande A. *The Checklist Manifesto: how to get things right*. New York, NY: Metropolitan Books; 2009.
- Munoz E, Munoz W 3rd, Wise L. National and surgical health care expenditures, 2005-2025. *Ann Surg* 2010; 251:195-200.
- Person B, Wexner SD. The management of postoperative ileus. *Curr Probl Surg* 2006; 43:12-65
- Senagore AJ. Pathogenesis and clinical and economic consequences of postoperative ileus. *Am J Health Syst Pharm* 2007;64:S3-7.
- Asgeirsson T. Postoperative ileus: it costs more than you think. *J Am Coll Surg* 2010 Feb; 210(2):228-31
- Goldstein JL, Matuszewski KA, Delaney CP, et al. Inpatient economic burden of postoperative ileus associated with abdominal surgery in the United States. *P&T* 2007; 32:82-90.