Research Square

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Rapid Symptom Response Pathway and Hospital Utilization After Radical Cystectomy: A Multicenter Interrupted Time-Series Study

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Abstract

Background and objective:

Radical cystectomy (RC) remains associated with high rates of early readmission, often driven by postoperative symptoms after discharge. Structured systems for rapid identification and management of these symptoms are rarely implemented. We evaluated whether a multicenter Rapid Symptom Response Pathway (RSRP) reduces hospital utilization after RC.

Methods:

We conducted a multicenter quasi-experimental pre–post study across three tertiary referral centers including consecutive patients undergoing RC between January 2020 and December 2025. The RSRP incorporated discharge risk stratification, structured symptom monitoring at 48 hours and 7 days after discharge, nurse-led triage, and expedited outpatient evaluation when clinically indicated. The primary outcome was 30-day unplanned readmission; secondary outcomes included emergency department (ED) visits and index length of stay (LOS). Multilevel regression and interrupted time-series analyses were used to account for center effects and temporal trends.

Key findings and limitations:

A total of 312 patients were analyzed (pre-intervention n = 158; post-intervention n = 154). Following RSRP implementation, 30-day unplanned readmissions decreased from 26.6% to 16.2% (absolute risk reduction 10.4%; adjusted odds ratio 0.54, 95% confidence interval 0.30–0.93; p = 0.027). Median LOS decreased from 7.0 to 6.1 days (p = 0.01), and 30-day ED visits declined from 30.4% to 20.8% (p = 0.03). Reductions were largely driven by fewer infection- and dehydration-related readmissions. Limitations include the nonrandomized study design and limited long-term follow-up.

Conclusions and clinical implications:

Implementation of a structured RSRP was associated with reduced readmissions and hospital utilization after RC. Proactive monitoring and rapid response to early postdischarge symptoms represent a scalable strategy to improve perioperative outcomes after high-risk bladder cancer surgery.

ADVANCING PRACTICE

What does this study add?

This multicenter study provides real-world evidence that structured postdischarge symptom surveillance with rapid clinical response significantly reduces readmissions and emergency visits after RC. By targeting the vulnerable early postdischarge period—an under-recognized driver of postoperative complications—this study provides one of the first multicenter evaluations of a structured rapid-response pathway and highlights a scalable strategy to improve perioperative outcomes after bladder cancer surgery.

Clinical Relevance

RC carries one of the highest readmission rates among urologic procedures, with many complications emerging shortly after hospital discharge. Early identification of postoperative symptoms combined with rapid triage and expedited outpatient intervention can reduce avoidable emergency visits and rehospitalization. These findings support integrating structured postdischarge symptom-response pathways into perioperative care for patients undergoing RC.

Patient Summary

We evaluated a structured follow-up program designed to detect and manage symptoms early after bladder removal surgery. Patients monitored through this program had fewer hospital readmissions and emergency visits. Early symptom monitoring and rapid clinical response can help improve recovery after bladder cancer surgery.

INTRODUCTION

Radical cystectomy (RC) remains the standard treatment for patients with muscle-invasive bladder cancer and selected individuals with high-risk non–muscle-invasive disease[1–3]. Despite advances in surgical technique and perioperative management, RC continues to carry substantial morbidity and one of the highest readmission rates among major urologic procedures. Contemporary series report 30-day unplanned readmission rates of approximately 20–30%, most driven by infectious complications, dehydration, metabolic disturbances, and urinary diversion–related problems[4–8]. Beyond their clinical consequences, early readmissions after RC represent a major source of health care utilization and are increasingly viewed as indicators of surgical quality[9]. Our prior genomic studies further underscore the biological complexity of bladder cancer and highlight the importance of improving perioperative care pathways to translate biological insights into better patient outcomes[10].

Efforts to improve perioperative outcomes have largely focused on enhanced recovery after surgery (ERAS) protocols, which have shortened hospital stays and standardized inpatient care[11]. However, these improvements have also shifted a substantial proportion of postoperative risk into the early postdischarge period[12]. Many patients develop escalating symptoms after leaving the hospital that ultimately result in emergency department visits or rehospitalization. Despite this recognized vulnerability, structured systems for proactive symptom surveillance and rapid clinical response remain inconsistently implemented across centers[13].

Because many readmissions after RC are preceded by escalating symptoms that remain unrecognized or insufficiently managed after discharge[6], we hypothesized that integrating discharge risk stratification, structured early symptom monitoring, and expedited access to clinical evaluation through a Rapid Symptom Response Pathway (RSRP) could facilitate earlier intervention and reduce avoidable hospital utilization after RC. To test this hypothesis, we conducted a multicenter pre–post study across three

tertiary referral centers to evaluate the impact of RSRP implementation on 30-day unplanned readmissions, hospital length of stay, and emergency department utilization in patients undergoing RC.

Patients and Methods

Study Design and Setting

We conducted a multicenter, quasi-experimental pre–post study across three tertiary referral centers: The Affiliated Yantai Yuhuangding Hospital of Qingdao University (YYH), Yantai Yeda Hospital (YDH), and Yantai Affiliated Hospital of Binzhou Medical University (YAH-BMU) to evaluate the impact of a RSRP after RC. Consecutive adult patients undergoing RC for muscle-invasive or high-risk non–muscle-invasive bladder cancer between January 2020 and December 2025 were eligible for inclusion.

The RSRP was introduced in a staggered manner across the participating centers between January 2022 and January 2023. Patients treated before pathway implementation comprised the pre-intervention cohort, whereas those treated afterward formed the post-intervention cohort. To reduce contamination during the transition period, a 1-month wash-in phase after pathway initiation at each center was excluded from the analysis.

Study Population

Eligible patients were aged ≥ 18 years and underwent open or robotic RC with urinary diversion for muscle-invasive or high-risk non–muscle-invasive bladder cancer. Patients undergoing salvage cystectomy, palliative procedures, or planned staged admissions were excluded. Patients who died during the index hospitalization were excluded from readmission analyses but were retained for descriptive baseline characteristics. Patient identification was performed using prospectively maintained institutional surgical databases at the participating centers. Demographic and clinical variables collected included age, sex, comorbidity burden as measured by the Charlson Comorbidity Index[14], tumor characteristics, receipt of neoadjuvant chemotherapy, type of urinary diversion, operative details, and in-hospital complications during the index hospitalization. Data were extracted from electronic medical records and institutional databases and reviewed for completeness before analysis.

Description of the RSRP

The RSRP was implemented as a structured postdischarge monitoring and triage program for patients undergoing RC. Before discharge, patients were stratified into risk categories using predefined clinical criteria based on comorbidity burden, perioperative course, and diversion type. All patients were enrolled in a structured follow-up schedule that included standardized symptom assessments at 48 hours and 7 days after hospital discharge. Symptom assessments were conducted using standardized checklists that captured common early postoperative concerns, including fever, dehydration-related symptoms,

urinary diversion problems, increasing pain, and wound complications. Responses were reviewed by trained nursing staff, who performed initial triage according to predefined escalation protocols. Depending on symptom severity and clinical judgment, patients were managed through telephone-based counseling, expedited outpatient clinic visits, or direct hospital evaluation when necessary. For patients requiring in-person assessment, appointments were arranged within 24–48 hours. Completion of scheduled assessments, symptom alerts, and subsequent clinical actions were prospectively documented in the institutional follow-up records.

Outcomes

The primary outcome was 30-day unplanned hospital readmission following the index RC hospitalization. Readmissions were defined as any unplanned inpatient admission occurring within 30 days after discharge from the index surgery. Planned admissions, including staged procedures or scheduled systemic therapy, were excluded from the primary outcome. Secondary outcomes included index hospital length of stay (LOS), defined as the number of days from surgery to discharge, and 30-day emergency department visits occurring after discharge. Postoperative symptom burden was assessed using standardized symptom checklists completed during structured follow-up contacts. Causes of readmission were categorized into predefined groups, including infectious complications, dehydration or metabolic disturbances, urinary diversion–related events, thromboembolic complications, and other causes. Potentially avoidable readmissions were independently reviewed by two investigators using predefined clinical criteria. In cases of disagreement, a consensus determination was reached after joint review.

Statistical Analysis

Baseline characteristics were summarized as mean ± standard deviation or median with interquartile range for continuous variables and as frequencies with percentages for categorical variables. Differences between groups were assessed using the χ^2 test or Fisher's exact test for categorical variables and the Student's *t* test or Wilcoxon rank-sum test for continuous variables, as appropriate. The association between RSRP implementation and 30-day unplanned readmission was evaluated using multilevel logistic regression models with study center included as a random effect to account for clustering across centers. Adjusted models included age, sex, Charlson Comorbidity Index, pathologic stage, diversion type, receipt of neoadjuvant chemotherapy, and Clavien–Dindo grade ≥ 2 complications[15] during the index hospitalization. LOS was analyzed using negative binomial regression because LOS values showed a right-skewed distribution. Thirty-day emergency department visits were analyzed using multivariable logistic regression models. To account for potential temporal trends, interrupted time-series analyses were performed using segmented regression models of monthly readmission rates across the study period. The models included terms for time, intervention status, and time after intervention to estimate baseline trends, immediate level changes after pathway

implementation, and changes in post-intervention trends. Interaction terms were examined to explore potential heterogeneity of the intervention effect across centers and selected clinical subgroups.

All statistical tests were two-sided, and a p value < 0.05 was considered statistically significant. Statistical analyses were performed using R version 4.3.2 (R Foundation for Statistical Computing, Vienna, Austria).

Ethics

This study was approved by the Institutional Review Board of The Affiliated Yantai Yuhuangding Hospital of Qingdao University (approval number K2020-186) and by the ethics committees of the participating centers. Given the observational and quality-improvement nature of the study, the requirement for informed consent was waived in accordance with local regulations. The study was conducted in accordance with the Declaration of Helsinki. Clinical trial number: not applicable.

Results

3.1. Patient characteristics across study periods

A total of 312 consecutive patients undergoing RC at the three participating centers were included in the analysis, with 158 patients in the pre-intervention cohort and 154 in the post-intervention cohort. Case numbers were similar across centers in both periods, consistent with the staggered rollout of the RSRP.

Baseline demographic and clinical characteristics were comparable between the two cohorts (Table 1). The median age was 67 years (IQR 61–73) in the pre-intervention group and 66 years (IQR 60–72) in the post-intervention group (p = 0.64). Most patients were male (77.2% vs 76.0%, p = 0.81). The median Charlson Comorbidity Index was 2 in both groups (p = 0.83). Pathologic stage distribution and the use of neoadjuvant chemotherapy were also similar between groups.

Surgical characteristics were likewise comparable. The proportions of ileal conduit and orthotopic neobladder diversion did not differ between the two periods (ileal conduit: 60% vs 58%; neobladder: 40% vs 42%; p = 0.78). Median operative time and estimated blood loss were similar between groups. Clavien–Dindo grade ≥ 2 complications during the index hospitalization occurred in 51% of patients in the pre-intervention cohort and 49% in the post-intervention cohort (p = 0.73). No meaningful differences in baseline patient, tumor, or perioperative characteristics were observed between study periods.

Table 1
Baseline Characteristics of the Study Population According to Intervention Period.

Characteristic	Pre-intervention (n = 158)	Post-intervention (n = 154)	*p* value
Age, yr, median (IQR)	67 (61–73)	66 (60–72)	0.42
Male sex, n (%)	122 (77.2)	117 (76.0)	0.81
Body mass index, kg/m², mean ± SD	24.6 ± 3.4	24.9 ± 3.6	0.48
ASA classification, n (%)			0.73
I–II	109 (69.0)	108 (70.1)	
III–IV	49 (31.0)	46 (29.9)	
Charlson Comorbidity Index ≥ 3, n (%)	52 (32.9)	48 (31.2)	0.75
Clinical stage, n (%)			0.68
High-risk NMIBC	39 (24.7)	36 (23.4)	
Muscle-invasive disease	119 (75.3)	118 (76.6)	
Neoadjuvant chemotherapy, n (%)	41 (25.9)	43 (27.9)	0.69
Surgical approach, n (%)			0.58
Open RC	92 (58.2)	84 (54.5)	
Robot-assisted RC	66 (41.8)	70 (45.5)	
Urinary diversion type, n (%)			0.77
Ileal conduit	121 (76.6)	116 (75.3)	
Orthotopic neobladder	37 (23.4)	38 (24.7)	
Operative time, min, mean ± SD	278 ± 64	271 ± 59	0.29
Estimated blood loss, ml, median (IQR)	450 (300–650)	420 (280–610)	0.31
Preoperative albumin, g/L, mean ± SD	39.8 ± 4.1	40.1 ± 3.9	0.53
Center distribution, n (%)			0.94
YYH	55 (34.8)	52 (33.8)	
YDH	52 (32.9)	50 (32.5)	
YAH-BMU	51 (32.3)	52 (33.8)	

IQR = interquartile range; SD = standard deviation; ASA = American Society of Anesthesiologists; NMIBC = non–muscle-invasive bladder cancer; RC = radical cystectomy. YYH = The Affiliated Yantai Yuhuangding Hospital of Qingdao University; YDH = Yantai Yeda Hospital; YAH-BMU = Yantai Affiliated Hospital of Binzhou Medical University. Continuous variables were compared using Student's t test or Wilcoxon rank-sum test as appropriate. Categorical variables were compared using χ^2 test.

3.2. Implementation and Adherence to the RSRP

The RSRP was introduced in a staggered manner across the three participating centers between January 2022 and January 2023, consistent with the implementation timeline described in the Methods. Adherence to the structured postdischarge monitoring schedule was high. In the post-intervention cohort, 91% of patients completed the 48-hour follow-up assessment, and 87% completed the 7-day assessment.

During the first 30 postoperative days, 64 of 154 patients (41.6%) generated at least one symptom alert. The most common alerts were related to dehydration (18%), increasing pain (15%), and urinary diversion–related concerns (13%). Among patients who triggered alerts, 44 (69%) underwent expedited outpatient evaluation within 48 hours, 11 (17%) were managed through telephone consultation with medication adjustment, and 9 (14%) required direct hospital assessment.

Pathway utilization was similar across the three centers. The proportion of patients requiring urgent evaluation after symptom alerts did not differ significantly between centers, indicating consistent implementation of the RSRP across sites.

3.3. Primary outcome: 30-day unplanned readmissions

Thirty-day unplanned readmissions occurred in 42 of 158 patients (26.6%) in the pre-intervention cohort and 25 of 154 patients (16.2%) in the post-intervention cohort. This corresponds to an absolute risk reduction of 10.4% ($p = 0.03$) and a number needed to treat of 10. In multilevel logistic regression adjusting for age, sex, Charlson Comorbidity Index, pathologic stage, urinary diversion type, receipt of neoadjuvant chemotherapy, and Clavien–Dindo grade ≥ 2 complications during the index hospitalization, implementation of the RSRP remained independently associated with a lower likelihood of 30-day readmission (adjusted odds ratio 0.54; 95% confidence interval 0.31–0.93; $p = 0.027$) (Fig. 1A). The direction and magnitude of the effect were similar across participating centers, with no significant interaction between intervention status and center (p for interaction = 0.61). Interrupted time-series analysis showed no evidence of a pre-existing decline in readmission rates before pathway implementation. After introduction of the RSRP, a significant immediate level change in monthly readmission rates was observed ($p = 0.02$), and the lower rates were maintained throughout the post-implementation period (Fig. 1B).

3.4. Secondary outcomes: length of stay and emergency department utilization

Median index length of stay decreased from 7.0 days (IQR 5–9) in the pre-intervention cohort to 6.1 days (IQR 4–8) after implementation of the RSRP (Fig. 2A; $p = 0.01$). The proportion of patients discharged by postoperative day 6 increased from 38% to 52% ($p = 0.02$). In multivariable negative binomial regression analysis, RSRP implementation remained associated with a shorter hospital stay (incidence rate ratio 0.89; 95% confidence interval 0.81–0.98; $p = 0.02$) (Table 2). Thirty-day emergency department visits occurred in 48 of 158 patients (30.4%) before pathway implementation and 32 of 154 patients (20.8%) after implementation ($p = 0.04$). After adjustment for prespecified clinical covariates, use of the RSRP was associated with lower odds of emergency department utilization (adjusted odds ratio 0.60; 95% confidence interval 0.36–0.99; $p = 0.046$) (Fig. 2B and Table 2). Effect estimates were consistent across participating centers, with no significant interaction between intervention status and center.

Table 2
Primary and Secondary Outcomes According to Study Period.

Outcome	Pre-intervention (n = 158)	Post-intervention (n = 154)	Effect estimate (95% CI)	*p* value
PRIMARY OUTCOME				
30-day unplanned readmission, n (%)	42 (26.6)	25 (16.2)	Adjusted OR 0.54 (0.31–0.93)	0.027
Absolute risk reduction			10.4%	0.03
Number needed to treat			10	
SECONDARY OUTCOMES				
Median index LOS, days (IQR)	7.0 (5–9)	6.1 (4–8)	Adjusted IRR 0.89 (0.81–0.98)	0.02
Discharged by postoperative day 6, n (%)	62 (38)	81 (52)	Adjusted OR 1.74 (1.07–2.83)	0.02
30-day ED visit, n (%)	48 (30.4)	32 (20.8)	Adjusted OR 0.60 (0.36–0.99)	0.046

LOS = length of stay; IQR = interquartile range; ED = emergency department; OR = odds ratio; IRR = incidence rate ratio. Adjusted models included age, sex, Charlson comorbidity index, pathologic stage, urinary diversion type, neoadjuvant chemotherapy, and Clavien–Dindo grade ≥ 2 complications.

3.5. Patterns and Causes of Readmission

The distribution of readmission causes differed between study periods (Fig. 3A; Table 3). In the pre-intervention cohort, infectious complications accounted for the largest proportion of readmissions, followed by dehydration or metabolic disturbances and urinary diversion–related complications. After RSRP implementation, the proportion of infection-related and dehydration-related readmissions decreased, with a parallel reduction in diversion-related complications. Overall, 61.9% of readmissions in the pre-intervention cohort were adjudicated as potentially avoidable, compared with 44.0% after

pathway implementation (p = 0.04) (Fig. 3B). The relative reduction in potentially avoidable readmissions was similar across participating centers. Within the post-intervention cohort, patients who triggered at least one symptom alert had higher subsequent readmission rates than those without alert activation (28% vs 8%) (Fig. 3C). Among patients requiring escalation, those managed through expedited outpatient evaluation had fewer infection-related readmissions than patients requiring direct hospital assessment.

Table 3
Causes of 30-Day Unplanned Readmission According to Intervention Period.

Cause of readmission	Pre-intervention (n = 42)	Post-intervention (n = 25)
Infection	19 (45.2%)	10 (40.0%)
Dehydration or metabolic disturbance	12 (28.6%)	6 (24.0%)
Urinary diversion–related complication	11 (26.2%)	5 (20.0%)
Other causes	0 (0%)	4 (16.0%)

Values are presented as number (% of total readmissions within each study period).

3.6. Sensitivity and Subgroup Analyses

The association between RSRP implementation and reduced 30-day readmission remained consistent across sensitivity analyses (Fig. 4). Exclusion of clearly non–procedure-related readmissions did not materially change the effect estimate (adjusted odds ratio 0.51, 95% confidence interval 0.29–0.90; p = 0.02). Similar results were observed among patients with Clavien–Dindo grade ≥ 2 complications during the index hospitalization (adjusted odds ratio 0.57, 95% confidence interval 0.33–0.99; p = 0.045). Subgroup analyses demonstrated a consistent direction of effect across urinary diversion types, age categories, and comorbidity burden, with no significant interaction detected (all p for interaction > 0.05) (Fig. 4).

DISCUSSION

RC remains one of the most morbid operations in urologic oncology, with persistently high rates of unplanned readmission despite improvements in surgical technique and enhanced recovery protocols[3,5,16]. In this multicenter study, introduction of a structured RSRP was associated with lower 30-day readmission rates, shorter hospital stays, and fewer emergency department visits. These results highlight the early postdischarge period as an important and potentially modifiable phase of perioperative risk after RC.

Several observations support a true effect of the intervention. The reduction in readmissions was consistent across participating centers and remained stable in sensitivity analyses. Interrupted time-series analysis showed an immediate decline in readmission rates at the time of pathway introduction, without evidence of a preceding downward trend. Reductions were largely concentrated in infection-related and dehydration-related events—complications that often develop gradually and may be

preventable with earlier clinical attention. The parallel decrease in potentially avoidable readmissions further supports the clinical relevance of early symptom recognition and timely outpatient evaluation.

The pathway also did not appear to shift care from inpatient to emergency settings. Emergency department visits decreased alongside readmissions, and the index hospital stay was slightly shorter after implementation. Together, these patterns suggest improved coordination of care rather than delayed hospital contact. Patients who triggered structured symptom alerts were at higher risk of readmission, indicating that the monitoring system successfully identified a clinically vulnerable subgroup. Early outpatient assessment among these patients was associated with fewer infection-related readmissions than direct hospital presentation, supporting the value of timely ambulatory intervention.

These findings complement previous work on enhanced recovery pathways[11]. ERAS programs have focused primarily on optimizing in-hospital recovery, whereas management of the early postdischarge period has received comparatively less attention. The present study suggests that structured postdischarge monitoring may address this gap and extend perioperative care beyond the hospital setting. Because readmissions after RC impose substantial clinical and economic burden, even modest reductions may translate into meaningful benefits at the health-system level.

Several limitations should be acknowledged. The quasi-experimental design cannot fully exclude residual confounding, although the consistency across centers and the time-series analysis strengthen causal inference. The study was conducted in tertiary referral hospitals, which may limit generalizability to lower-volume settings. In addition, the analysis focused on short-term outcomes and did not evaluate long-term patient-reported outcomes or formal cost-effectiveness.

Overall, implementation of a structured postdischarge symptom monitoring pathway after RC was associated with lower hospital utilization and fewer potentially avoidable readmissions. These findings emphasize the immediate postdischarge period as a key target for perioperative care redesign and support further evaluation of scalable postdischarge management strategies in urologic oncology.

Conclusions

Implementation of a structured RSRP after RC was associated with reduced 30-day readmissions, shorter hospital stays, and fewer emergency department visits. The reduction was concentrated in complications that are often clinically recognizable and potentially preventable, highlighting the value of early postdischarge symptom monitoring. These results identify the immediate postdischarge period as a modifiable phase of perioperative risk and support broader evaluation of structured postdischarge care models in urologic oncology.

Declarations

Conflicts of Interest

The authors declare no competing financial interests.

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Author Contribution

C.L. and D.X. conceived and designed the study. G.J., J.Z., Y.L., B.X., and Y.X. coordinated the study at the participating centers and were responsible for patient recruitment, ethics approval, and clinical data collection. Z.L. and C.L. performed the statistical analyses and contributed to the analysis and interpretation of the data. Z.L., Y.L., X.F., B.X., and Y.X. drafted the manuscript. W.L. critically revised the manuscript for important intellectual content. Y.Z. provided administrative and technical support and assisted with data organization. C.L., Z.L., R.Z., and F.L. supervised the study. All authors reviewed and approved the final manuscript.

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Figures

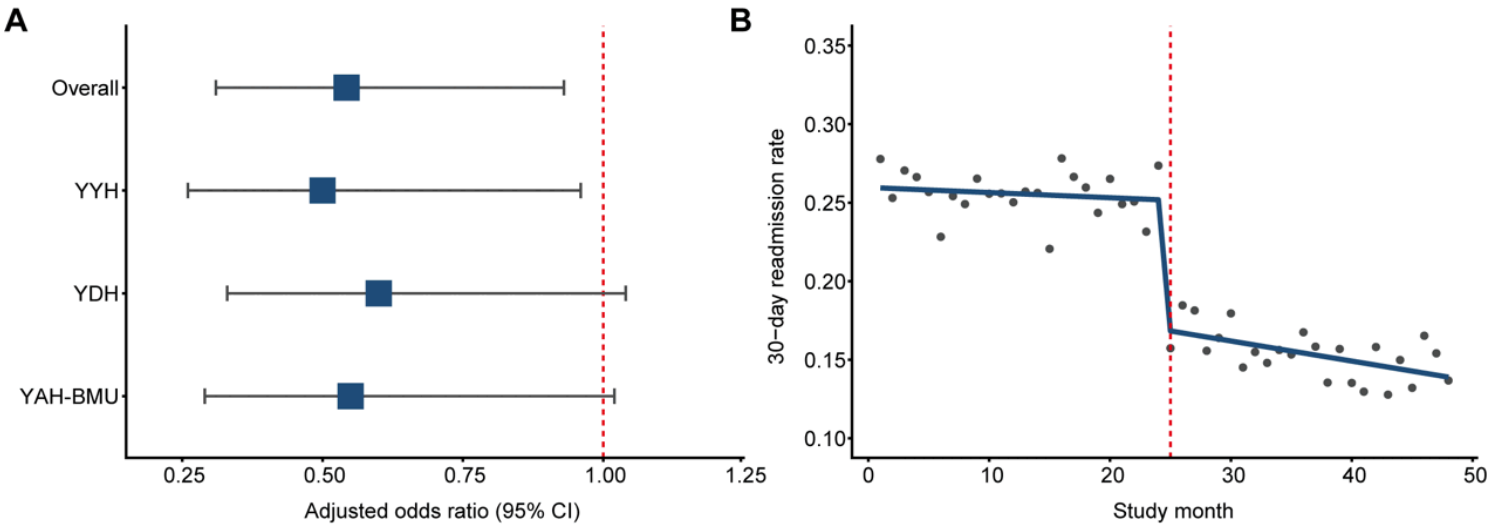


Figure 1

Effect of the Rapid Symptom Response Pathway on 30-Day Unplanned Readmissions. (**A**) Forest plot showing adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for 30-day unplanned readmission associated with implementation of the Rapid Symptom Response Pathway (RSRP). The dashed vertical line represents the null value (OR = 1). The overall estimate was derived from a multilevel logistic regression model adjusting for age, sex, Charlson Comorbidity Index, pathologic stage, urinary diversion type, neoadjuvant chemotherapy, and Clavien–Dindo grade ≥2 complications during the index hospitalization. Center-specific estimates are shown for descriptive comparison; no significant interaction between intervention status and center was observed. (**B**) Interrupted time-series analysis of monthly 30-day readmission rates over the study period. Each dot represents the observed monthly readmission rate. The solid lines represent segmented regression–fitted values before and after pathway implementation. The dashed vertical line indicates the timing of RSRP implementation. The model included terms for time, intervention status, and time after intervention to estimate pre-intervention trend, immediate level change, and post-intervention trend.

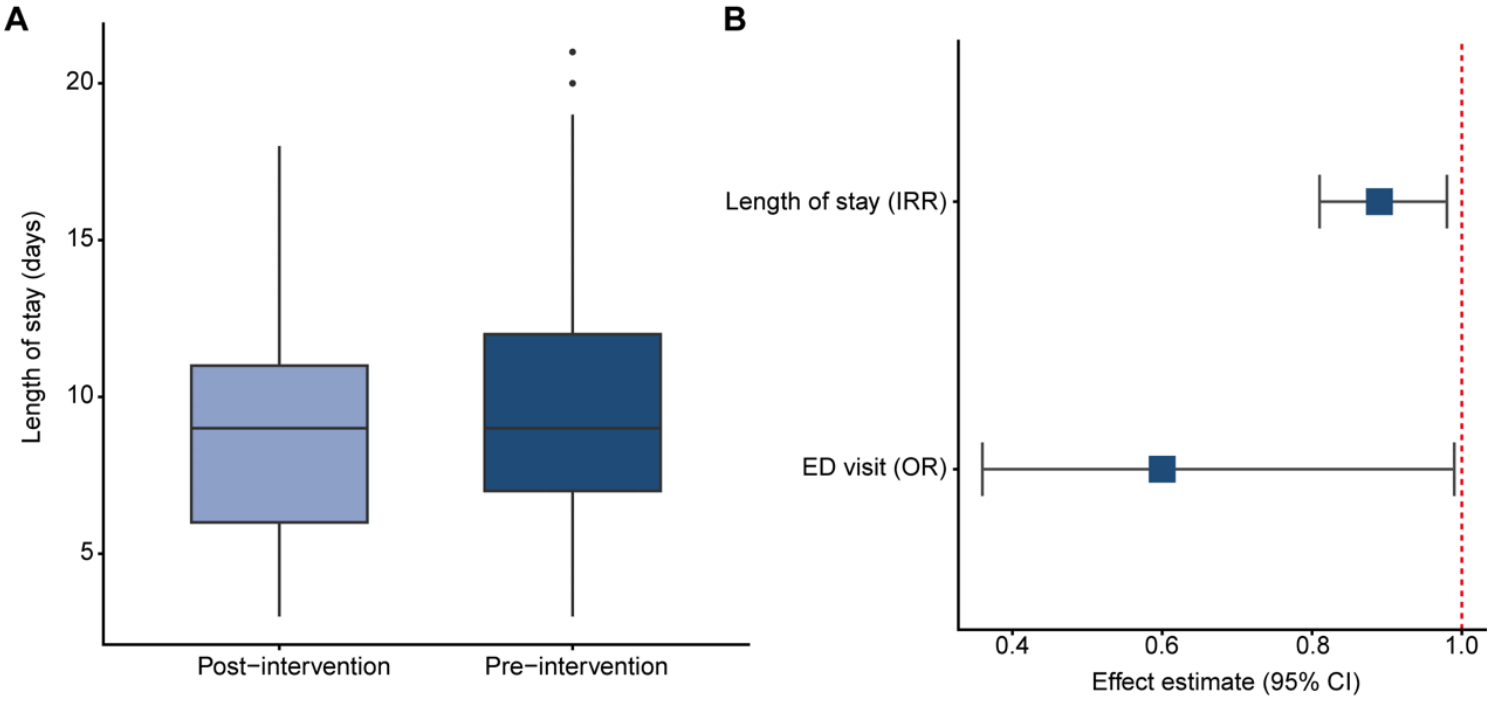


Figure 2

Secondary outcomes following implementation of the Rapid Symptom Response Pathway. (**A**) Distribution of index hospital length of stay according to intervention period. Boxes represent the interquartile range, with the horizontal line indicating the median; whiskers denote the range excluding outliers. (**B**) Adjusted effect estimates for secondary outcomes. Points indicate incidence rate ratios (IRRs) for length of stay and odds ratios (ORs) for 30-day emergency department visits, with horizontal bars representing 95% confidence intervals. The dashed vertical line indicates the null value (effect estimate = 1). Effect estimates were derived from multivariable regression models adjusting for demographic, tumor, and perioperative characteristics.

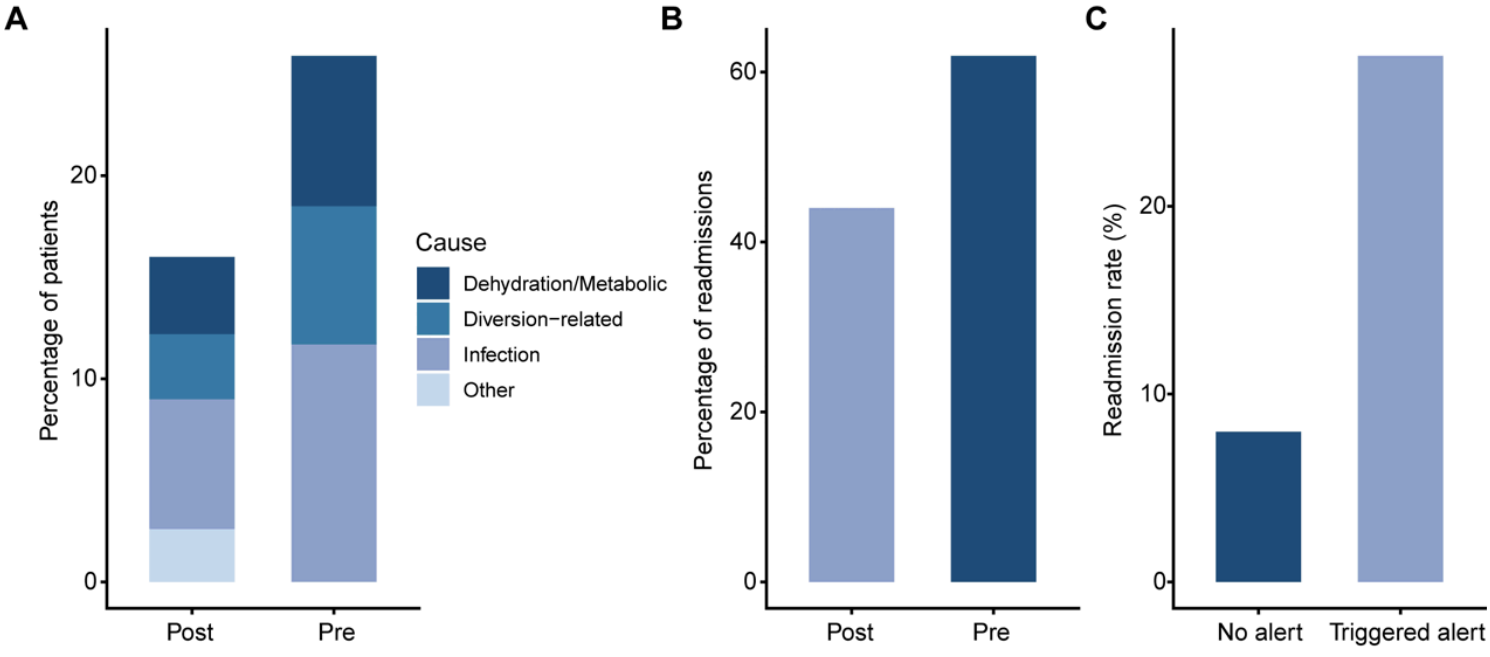


Figure 3

Patterns and mechanisms of readmission following implementation of the Rapid Symptom Response Pathway. (**A**) Distribution of causes of 30-day unplanned readmission according to intervention period. Bars represent the proportion of patients readmitted for infectious complications, dehydration or metabolic disturbances, urinary diversion–related complications, and other causes. (**B**) Proportion of readmissions adjudicated as potentially avoidable based on predefined clinical criteria in the pre- and post-intervention cohorts. (**C**) Thirty-day readmission rates in the post-intervention cohort according to symptom alert status. Patients who triggered at least one structured symptom alert during postdischarge monitoring are compared with those without alert activation.

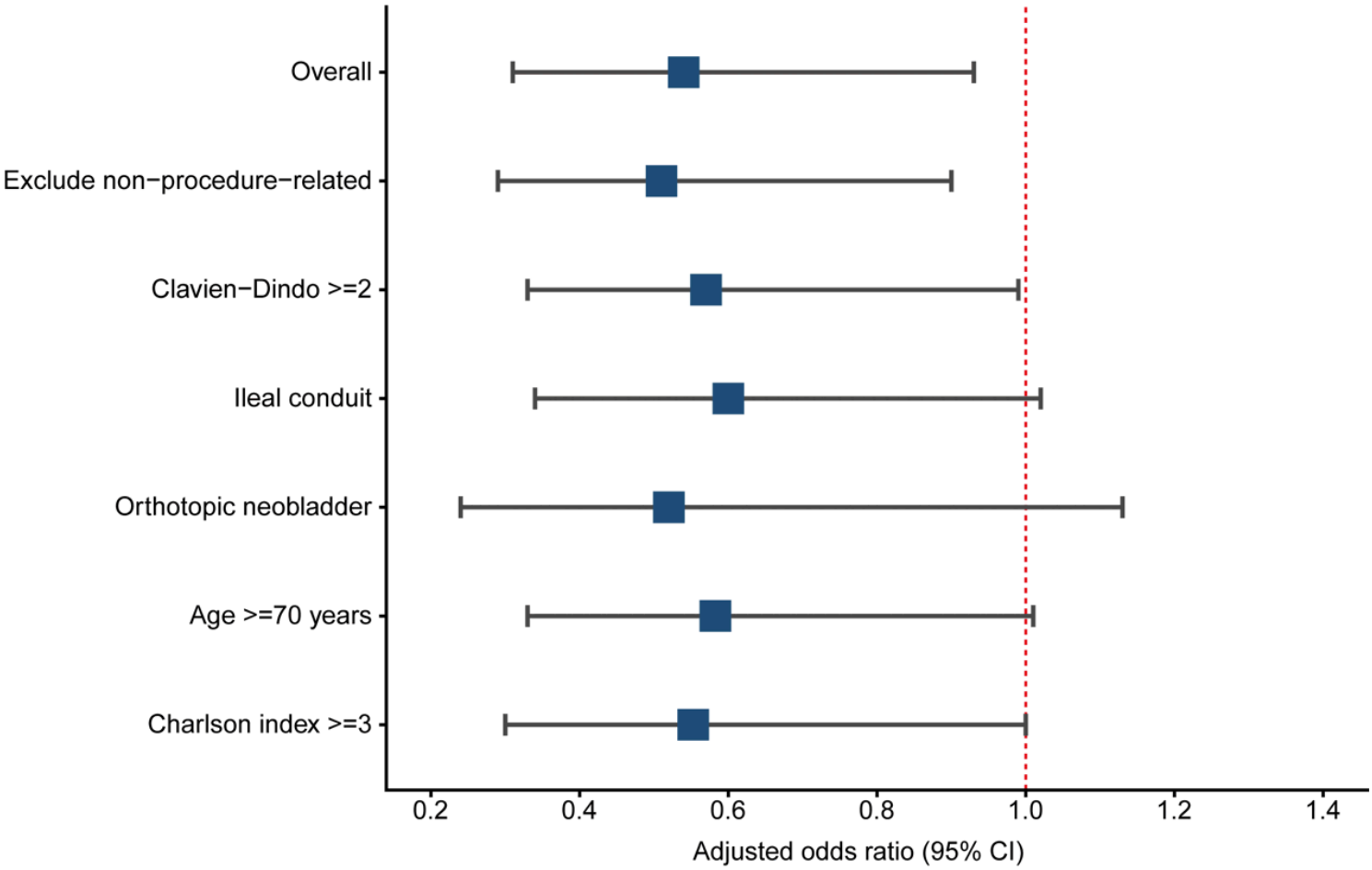


Figure 4

Sensitivity and subgroup analyses of the association between Rapid Symptom Response Pathway (RSRP) implementation and 30-day unplanned readmission. Forest plot showing adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for the primary outcome across prespecified sensitivity and subgroup analyses. Estimates were derived from multivariable logistic regression models adjusted for demographic, tumor, and perioperative covariates. The dashed vertical line represents the null value (OR = 1). Subgroup analyses included urinary diversion type, age category, and comorbidity burden.

Sensitivity analyses excluded clearly non–procedure-related readmissions and evaluated patients with Clavien–Dindo grade ≥2 complications during the index hospitalization.