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Original article

Enhancing Operational Efficiency by Reducing Patient Length of Stay and Increasing Patient Satisfaction: An Applied Study at King Saud Medical City

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Abstract

Background: Coordinated discharge processes and clinical pathways support hospital efficiency, and their implementation requires evaluation using operational and clinical outcomes. This study assessed length of stay (LOS) and discharge outcomes following deployment of a multicomponent operational improvement programme at King Saud Medical City, Riyadh. Methods: This retrospective, uncontrolled before-and-after study used routinely collected discharge records. The programme combined discharge coordination, multidisciplinary review, perioperative recovery pathways, cardiology service redesign, and ambulatory preparation. The primary analysis compared January-March 2022 with January-March 2023, when the programme was fully deployed. LOS and discharge outcomes were compared, and multivariable logistic regression assessed hospitalization exceeding seven days, adjusting for age group, sex, admission type, hospital, and ward. Results: The primary comparison included 20,981 discharges. Mean LOS

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02/11/2026

decreased from 8.74 to 8.43 days (mean difference −0.31 days; 95% confidence interval [CI] −0.69 to 0.06; p=0.102), while median LOS remained four days. Hospitalization exceeding seven days occurred in 31.7% and 31.1% of discharges, respectively. Adjusted odds were lower in 2023 (adjusted odds ratio 0.926; 95% CI 0.869-0.987; p=0.019). Improved discharge outcomes increased from 88.8% to 90.5%, and mortality decreased from 5.0% to 4.1%. **Conclusions:** Programme deployment was associated with modestly lower adjusted odds of prolonged hospitalization, without a statistically significant reduction in mean LOS. Changes in discharge outcomes were unadjusted and cannot establish programme effectiveness. Patient satisfaction and readmissions were not measured.

Keywords: Length of stay; Patient discharge; Hospital efficiency; Quality improvement; Patient flow; Saudi Arabia.

Introduction

Hospital efficiency depends on coordinating admissions, treatment, and discharge while maintaining safe access to inpatient beds. A stochastic simulation showed how fluctuations in emergency demand can generate bed shortages as occupancy rises (1). In an observational cohort, longer emergency department boarding was associated with higher mortality and longer hospital stays (2). These findings position patient flow as a clinical and organizational concern with implications for service availability and patient outcomes.

Delayed discharge has been associated with infections, reduced mobility, and pressures on staff, but much of this evidence is observational and methodologically limited (3). Interventions targeting prolonged stays have produced inconsistent results across medically complex populations, suggesting that effectiveness depends on patient characteristics and the delivery context (4).

Lean healthcare focuses on removing activities that do not add value and improving workflow; a systematic review found shorter LOS in 16 of 23 studies reporting this outcome (5). Criteria-led discharge uses agreed conditions to facilitate appropriate discharge, with implementation processes influencing its safety and effectiveness (6). Early discharge planning also improve continuity, a meta-analysis in older adults found fewer readmissions, despite no significant reduction in the initial hospital stay (7).

Enhanced Recovery After Surgery combines multidisciplinary perioperative care, early mobilization, nutritional management, and systematic audit (8). Its effects can differ across settings: following implementation for elective cesarean delivery, recovery processes improved and opioid exposure decreased without a significant change in LOS (9).

Patient experience adds another dimension to this assessment. Evidence links better experience with clinical effectiveness and safety, although such associations do not establish causation (10). Communication interventions at discharge have also been associated with fewer readmissions, better treatment adherence, and higher satisfaction (11).

Within Saudi Arabia, restructuring a pediatric inpatient service was associated with shorter LOS and stable readmission rates, demonstrating the relevance of organizational change to local services (12). Findings from individual services cannot establish the performance of a combined programme across heterogeneous hospital departments. This study evaluated LOS and discharge outcomes following full deployment of a multicomponent operational improvement

02/11/2026

programme at King Saud Medical City, Riyadh. The programme combined discharge coordination, multidisciplinary review of prolonged stays, perioperative recovery pathways, cardiology service redesign, and ambulatory preparation, providing an opportunity to examine operational improvement in practice. The analysis focused on corresponding January-March periods in 2022 and 2023 and factors associated with hospitalization exceeding seven days.

Methods

Study design and setting

A retrospective observational study was conducted at King Saud Medical City (KSMC), Riyadh, Saudi Arabia, to evaluate length of stay (LOS) and discharge outcomes following implementation of a multicomponent operational improvement programme. Full deployment of the combined programme began in January 2023. The primary evaluation used an uncontrolled before-and-after comparison of discharges during January-March 2022 and January-March 2023, aligning the calendar months in the two periods. Full-year data from 2021 and 2022 were examined in secondary analyses. Individual programme components had previously been developed as separate improvement projects; and the primary comparison evaluated outcomes before and after full deployment of the combined programme.

Data sources and study population

The study used routinely collected hospital discharge data covering 1 January-31 December 2021, 1 January-31 December 2022, and 1 January-31 March 2023. All eligible discharge records in these datasets were included. The unit of analysis was the discharge record, and sample counts represented hospital discharges. Available variables included admission and discharge dates, age group, sex, admission type, hospital, ward or section, and discharge outcome.

The source datasets contained 74,830 records. Records with discharge dates outside the calendar year assigned to their source dataset were excluded. This removed 175 records from the 2021 file and left 74,655 eligible discharges. A further 4,756 records from 2021 had negative LOS values and were excluded from LOS analyses but retained for analyses of patient characteristics and discharge outcomes. 69,899 records were available for LOS analyses. The primary comparison comprised 10,390 discharges in January-March 2022 and 10,591 in January-March 2023.

Multicomponent operational improvement programme

The programme was developed using a FOCUS-Plan-Do-Check-Act improvement approach to identify causes of prolonged hospitalization and discharge delays. Its components addressed discharge coordination, perioperative care, cardiology services, ambulatory preparation, and multidisciplinary management of prolonged stays.

Discharge coordination included a discharge lounge for patients approved for discharge who were awaiting medications, appointments, or family collection. Criteria-led discharge used agreed clinical and social criteria to support timely discharge, with discharge planning initiated on the first day of admission. The multidisciplinary team intervened when hospitalization reached seven days to facilitate discharge, address barriers to post-acute placement, and coordinate home medical supplies when required.

02/11/2026

An Enhanced Recovery After Surgery pathway was introduced for eligible low-risk women undergoing planned cesarean delivery who agreed to participate. Components included preoperative counselling and nutritional preparation, avoidance of prolonged fasting, carbohydrate loading up to two hours before surgery, standardized anesthesia and analgesia, and early mobilization. Delivery involved obstetric, anesthesia, pediatric, midwifery, and nursing personnel, health educators, and discharge planners.

Cardiology service changes included a policy to complete scheduled catheterization procedures on the same day, reorganization of the heart health center into coronary care and cardiac intensive care units, and expansion of cardiac intensive care capacity from 22 to 40 beds. A dedicated team comprising cardiologists, charge nurses, and case managers coordinated discharge and transfer back to referring hospitals after completion of specialized treatment.

Ambulatory preoperative preparation was promoted for clinically stable patients awaiting elective surgery. Eight virtual beds supported selected patients through structured follow-up before admission. Suitable hand surgery cases were redirected to semi-elective day surgery pathways. These components were implemented as a combined programme; the analysis evaluated outcomes at programme level rather than estimating the independent effects of individual components.

Study variables and outcome definitions

LOS was calculated in days from admission and discharge dates. The principal outcome was inpatient LOS, assessed as a continuous variable and as prolonged hospitalization exceeding seven days. LOS exceeding 14 days was examined as an additional threshold. Discharge outcomes were categorized as improved, death, discharge against medical advice, transfer to another institution, absconding, discharge to a rehabilitation center, or death on arrival.

Age was categorized as <15, 15-25, 26-35, 36-45, 46-55, and >55 years. Age-group, sex, admission-type, hospital, ward, and discharge-outcome labels were standardized across datasets. Missing or implausible age values were reported separately and retained as a distinct category in the adjusted analysis.

Statistical analysis

All statistical analyses were performed using IBM SPSS Statistics (IBM Corp., Armonk, NY, USA). Because LOS was right-skewed, continuous data were summarized using means and standard deviations together with medians and interquartile ranges. Categorical variables were reported as frequencies and percentages. Differences in patient characteristics and discharge outcomes between study periods were assessed using Pearson's chi-square test, with Cramér's V used to quantify association strength.

Mean LOS was compared using Welch's t-test, and LOS distributions were compared using the Mann-Whitney U test. Mean differences with 95% confidence intervals were reported, and rank-biserial correlations quantified effect sizes for distributional comparisons. Risk ratios with 95% confidence intervals were calculated for binary outcomes. The January-March comparison was the primary analysis; comparisons using the complete source-year datasets were considered secondary

02/11/2026

because 2023 covered only the first quarter and the 2021 dataset contained invalid LOS values. P-values were adjusted using the Holm method where multiple pairwise comparisons were undertaken.

A multivariable logistic regression model with robust standard errors examined the association between the post-deployment period and LOS exceeding seven days in the January-March 2022 and 2023 cohorts. The model adjusted for age group, sex, admission type, hospital, and ward. Reference categories were January-March 2022, age <15 years, male sex, emergency admission, General Hospital, and general ward. Associations were expressed as adjusted odds ratios with 95% confidence intervals. Model discrimination was assessed using the area under the receiver operating characteristic curve. All tests were two-sided, and statistical significance was defined as $p<0.05$.

Ethical approval

Ethical approval was obtained from the Institutional Review Board of King Saud Medical City, Riyadh, Saudi Arabia (reference number H1RI-15-Oct26-05).

Results

The three datasets contained 74,830 records. After excluding 175 records assigned to the 2021 file but discharged in 2022, 74,655 eligible discharges remained: 23,589 in 2021, 40,475 in 2022, and 10,591 from January through March 2023. The 2023 dataset contained no discharges after March 31. A further 4,756 records from 2021 had negative length-of-stay (LOS) values and were excluded only from LOS analyses, leaving 69,899 records with valid LOS. Age was missing or implausible in 175 records (0.2%) (Table 1).

Patient characteristics differed between the three periods (Table 2). The proportion of male patients was 61.3% in 2021, 52.4% in 2022, and 54.5% in January-March 2023. The proportion managed in general wards increased from 72.4% in 2021 to 79.5% in 2022 and 89.7% in January-March 2023. Although the age, sex, admission-type, hospital, and ward distributions all differed statistically between periods (all $p<0.001$), the corresponding effect sizes were small to modest; the largest difference concerned hospital distribution (Cramér's $V=0.164$).

The primary LOS comparison was restricted to January-March in 2022 and 2023 to ensure equivalent follow-up periods. This analysis included 20,981 discharges. Mean LOS decreased from 8.74 days (SD 13.92) in 2022 to 8.43 days (SD 13.98) in 2023, corresponding to an unadjusted mean difference of −0.31 days (95% CI −0.69 to 0.06; Welch's $p=0.102$). Median LOS was 4 days in both periods, with an interquartile range of 2-10 days in 2022 and 2-9 days in 2023; the distributions did not differ significantly (Mann-Whitney $p=0.581$). Prolonged hospitalization exceeding seven days occurred in 31.7% and 31.1% of discharges, respectively (risk ratio 0.981, 95% CI 0.942-1.021; $p=0.340$) (Table 3; Figures 1 and 2).

Discharge outcomes differed between the matched periods, although the overall association was small ($\chi^2=26.62$, $df=5$, $p<0.001$; Cramér's $V=0.036$). The proportion discharged with an improved outcome increased from 88.8% in January-March 2022 to 90.5% in January-March 2023. In the same comparison, in-hospital mortality decreased from 5.0% to 4.1%, and transfers to another institution decreased from 3.2% to 2.6%. There was no

02/11/2026

statistically significant change in discharge against medical advice (p=0.130), absconding (p=0.069), or discharge to rehabilitation (p=0.113) (Table 4; Figure 3).

After adjustment for age group, sex, admission type, hospital, and ward, discharges in January-March 2023 had lower odds of LOS exceeding seven days than those in the corresponding 2022 period (adjusted odds ratio [aOR] 0.926, 95% CI 0.869-0.987; p=0.019). Increasing age was associated with higher odds of prolonged LOS, ranging from an aOR of 1.65 in patients aged 15-25 years to 2.36 among those older than 55 years, relative to patients younger than 15 years. Accepted admissions (aOR 1.675), adult intensive care (aOR 2.132), neonatal intensive care (aOR 2.186), and pediatric intensive care (aOR 4.023) were associated with higher odds of prolonged hospitalization. Elective admission (aOR 0.195), maternity-hospital care (aOR 0.162), and coronary care unit admission (aOR 0.303) were associated with lower odds. Sex was associated with prolonged LOS (p=0.453). The adjusted model had an area under the receiver operating characteristic curve of 0.719 (Table 5).

Table 1. Data coverage and completeness by year

Panel A. Cohort assembly				
Year	**Coverage**	**Records received**	**Outside designated discharge year, n**	**Eligible discharges, n**
2021	1 Jan-31 Dec 2021	23,764	175	23,589
2022	1 Jan-31 Dec 2022	40,475	0	40,475
2023	1 Jan-31 Mar 2023	10,591	0	10,591
Total	**1 Jan 2021-31 Mar 2023**	**74,830**	**175**	**74,655**
Panel B. Analytic completeness				
Year	**Negative/invalid LOS excluded, n (%)**	**Valid LOS analytic sample, n**	**Missing/implausible age, n (%)**	
2021	4,756 (20.2)	18,833	74 (0.3)	
2022	0 (0.0)	40,475	74 (0.2)	
2023	0 (0.0)	10,591	27 (0.3)	
Total	**4,756 (6.4)**	**69,899**	**175 (0.2)**	

02/11/2026

Table 2. Demographic and clinical characteristics of eligible discharges by year

Characteristic	Category	2021 n (%)	2022 n (%)	2023 Jan-Mar n (%)	P value	Cramér's V
Age group, years	<15	6,742 (28.6)	10,641 (26.3)	3,094 (29.2)	<0.001	0.062
	15-25	2,094 (8.9)	4,445 (11.0)	1,059 (10.0)	—	—
	26-35	2,883 (12.2)	7,024 (17.4)	1,542 (14.6)	—	—
	36-45	3,003 (12.7)	5,716 (14.1)	1,465 (13.8)	—	—
	46-55	3,053 (12.9)	4,256 (10.5)	1,148 (10.8)	—	—
	>55	5,740 (24.3)	8,319 (20.6)	2,256 (21.3)	—	—
	Missing/invalid	74 (0.3)	74 (0.2)	27 (0.3)	—	—
Sex	M	14,459 (61.3)	21,214 (52.4)	5,775 (54.5)	<0.001	0.080
	F	9,130 (38.7)	19,261 (47.6)	4,816 (45.5)	—	—
	Unknown	0 (0.0)	0 (0.0)	0 (0.0)	—	—
Admission type	Emergency	18,701 (79.3)	32,676 (80.7)	8,378 (79.1)	<0.001	0.022
	Urgent	1,081 (4.6)	1,520 (3.8)	390 (3.7)	—	—
	Elective	3,204 (13.6)	5,433 (13.4)	1,599 (15.1)	—	—
	Accepted	602 (2.6)	840 (2.1)	224 (2.1)	—	—
	Other/unknown	1 (0.0)	6 (0.0)	0 (0.0)	—	—
Hospital	General Hospital	17,681 (75.0)	24,315 (60.1)	6,517 (61.5)	<0.001	0.164
	Maternity Hospital	343 (1.5)	7,170 (17.7)	1,440 (13.6)	—	—
	Pediatric Hospital	5,565 (23.6)	8,842 (21.8)	2,563 (24.2)	—	—
	RDC	0 (0.0)	148 (0.4)	71 (0.7)	—	—

02/11/2026

Characteristic	Category	2021 n (%)	2022 n (%)	2023 Jan-Mar n (%)	P value	Cramér's V
Ward/section	General ward	17,081 (72.4)	32,195 (79.5)	9,499 (89.7)	<0.001	0.118
	CCU	1,878 (8.0)	3,359 (8.3)	195 (1.8)	—	—
	Adult ICU	2,535 (10.7)	2,246 (5.5)	121 (1.1)	—	—
	NICU	1,575 (6.7)	2,060 (5.1)	535 (5.1)	—	—
	PICU	520 (2.2)	615 (1.5)	241 (2.3)	—	—

Table 3. Length-of-stay outcomes and statistical comparisons

Panel A. Descriptive LOS outcomes					
Period	**Valid LOS, n**	**Mean (SD), days**	**Median (IQR), days**	**LOS >7 days, n (%)**	**LOS >14 days, n (%)**
2021	18,833	24.73 (17.80)	21.00 (13.00-35.20)	16,270 (86.4)	13,551 (72.0)
2022	40,475	8.71 (14.10)	4.00 (2.00-9.00)	12,691 (31.4)	6,372 (15.7)
2023 (Jan-Mar)	10,591	8.43 (13.98)	4.00 (2.00-9.00)	3,291 (31.1)	1,565 (14.8)
2022 (Jan-Mar)	10,390	8.74 (13.92)	4.00 (2.00-10.00)	3,292 (31.7)	1,689 (16.3)
2023 (Jan-Mar; matched comparison)	10,591	8.43 (13.98)	4.00 (2.00-9.00)	3,291 (31.1)	1,565 (14.8)
Panel B. Pairwise LOS comparisons (later period minus earlier period)					
Comparison	**Mean difference, days (95% CI)**	**Welch P**	**Mann-Whitney P**	**Rank-biserial correlation**	**Inference**
2022 vs 2021	-16.02 (-16.31 to -15.73)	<0.001	<0.001	-0.662	Statistically significant

02/11/2026

2023 vs 2021	-16.30 (-16.67 to -15.93)	<0.001	<0.001	-0.673	Statistically significant
2023 vs 2022	-0.28 (-0.58 to 0.02)	0.066	0.276	0.007	No statistically significant difference
Matched Jan-Mar 2023 vs Jan-Mar 2022	-0.31 (-0.69 to 0.06)	0.102	0.581	0.004	No statistically significant difference

Table 4. Discharge outcomes by year and matched intervention period

Panel A. Discharge outcomes by source year				
Discharge outcome	**2021, n (%)**	**2022, n (%)**	**2023 Jan-Mar, n (%)**	**All eligible discharges, n (%)**
Improved	20,372 (86.4)	36,208 (89.5)	9,584 (90.5)	66,164 (88.6)
Death	1,696 (7.2)	1,902 (4.7)	434 (4.1)	4,032 (5.4)
DAMA	751 (3.2)	1,025 (2.5)	243 (2.3)	2,019 (2.7)
Transferred	578 (2.5)	1,123 (2.8)	275 (2.6)	1,976 (2.6)
Absconded	173 (0.7)	192 (0.5)	53 (0.5)	418 (0.6)
Rehabilitation center	15 (0.1)	25 (0.1)	2 (0.0)	42 (0.1)
Death on arrival	4 (0.0)	0 (0.0)	0 (0.0)	4 (0.0)
Panel B. Matched January-March 2023 versus January-March 2022				
Discharge outcome	**2022 Jan-Mar, n (%)**	**2023 Jan-Mar, n (%)**	**Risk ratio (95% CI)**	**P value**
Improved	9,222 (88.8)	9,584 (90.5)	1.020 (1.010-1.029)	<0.001
Death	519 (5.0)	434 (4.1)	0.820 (0.724-0.929)	0.002
DAMA	272 (2.6)	243 (2.3)	0.876 (0.739-1.040)	0.130
Transferred	335 (3.2)	275 (2.6)	0.805 (0.688-0.942)	0.007
Absconded	35 (0.3)	53 (0.5)	1.486 (0.970-2.275)	0.069

02/11/2026

Rehabilitation center	7 (0.1)	2 (0.0)	0.280 (0.058-1.349)	0.113
Death on arrival	0 (0.0)	0 (0.0)	—	—

Table 5. Multivariable predictors of prolonged LOS (>7 days) in matched January-March 2022 and 2023 cohorts

Predictor	**Comparison/reference**	**Adjusted odds ratio**	**95% CI**	**P value**
Period				
January-March 2022	Reference	1.000	—	—
January-March 2023	Jan-Mar 2023 vs Jan-Mar 2022	0.926	0.869-0.987	0.019
Sex				
Male	Reference	1.000	—	—
Female	Female vs male	0.974	0.910-1.043	0.453
Age group				
<15 years	Reference	1.000	—	—
15-25 years	vs <15 years	1.658	1.365-2.014	<0.001
26-35 years	vs <15 years	1.856	1.538-2.240	<0.001
36-45 years	vs <15 years	1.926	1.599-2.320	<0.001
46-55 years	vs <15 years	2.235	1.852-2.698	<0.001
>55 years	vs <15 years	2.364	1.981-2.822	<0.001
Missing/invalid	vs <15 years	5.262	2.940-9.419	<0.001
Admission type				
Emergency	Reference	1.000	—	—
Urgent	vs emergency	0.880	0.757-1.024	0.098
Elective	vs emergency	0.195	0.170-0.224	<0.001

02/11/2026

Predictor	Comparison/reference	Adjusted odds ratio	95% CI	P value
Accepted	vs emergency	1.675	1.361-2.061	<0.001
Hospital				
General Hospital	Reference	1.000	—	—
Maternity Hospital	vs General Hospital	0.162	0.140-0.188	<0.001
Pediatric Hospital	vs General Hospital	0.833	0.691-1.003	0.054
RDC	vs General Hospital	0.095	0.013-0.712	0.022
Ward/section				
General ward	Reference	1.000	—	—
CCU	vs general ward	0.303	0.256-0.359	<0.001
Adult ICU	vs general ward	2.132	1.810-2.510	<0.001
NICU	vs general ward	2.186	1.891-2.527	<0.001
PICU	vs general ward	4.023	3.238-4.999	<0.001

02/11/2026

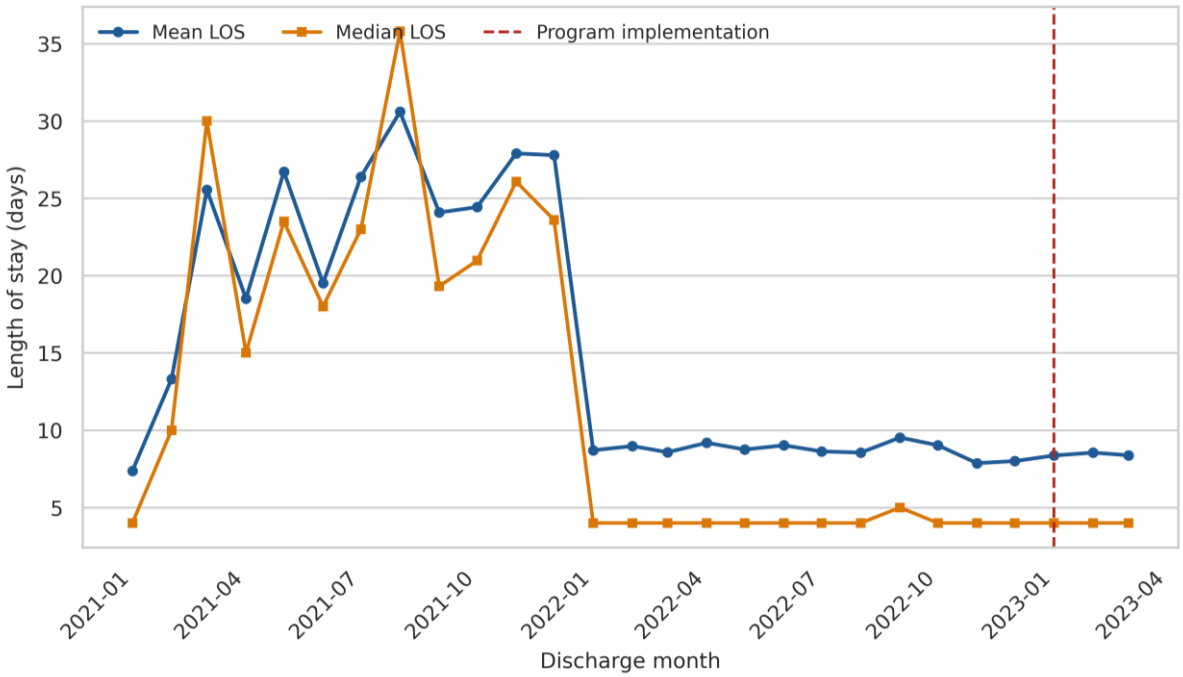


Figure 1. Monthly mean and median length of stay.

02/11/2026

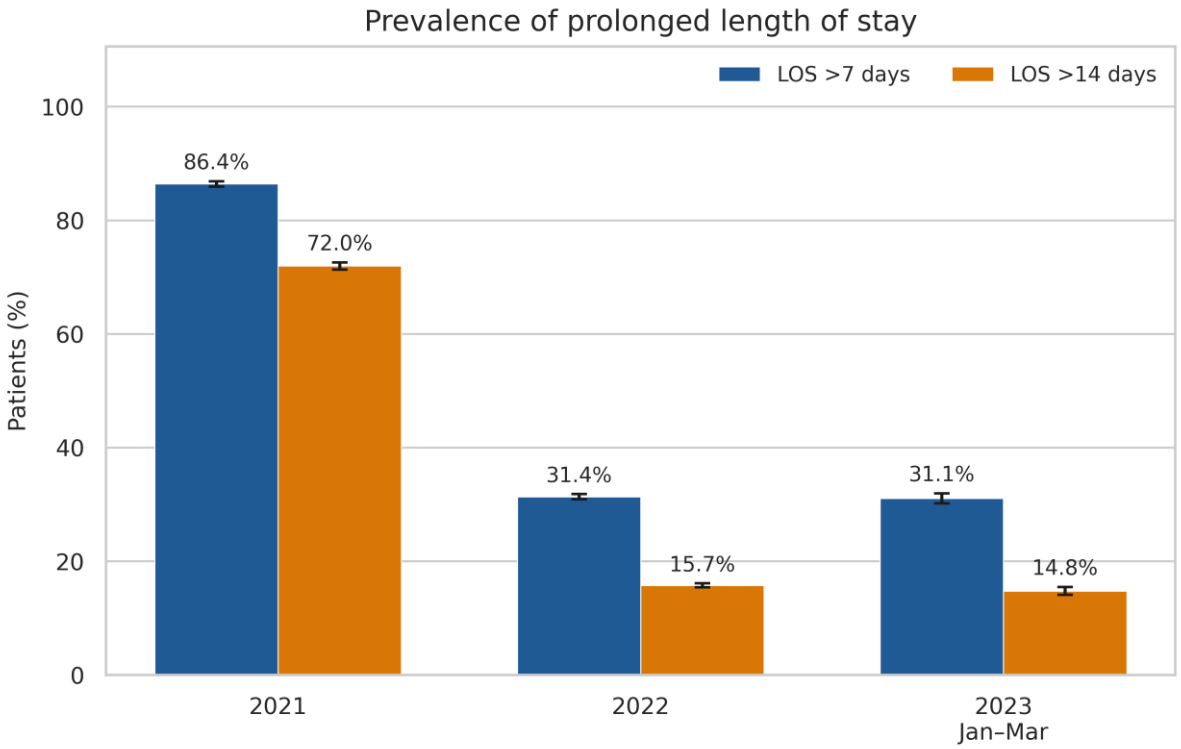


Figure 2. Prevalence of prolonged length of stay

02/11/2026

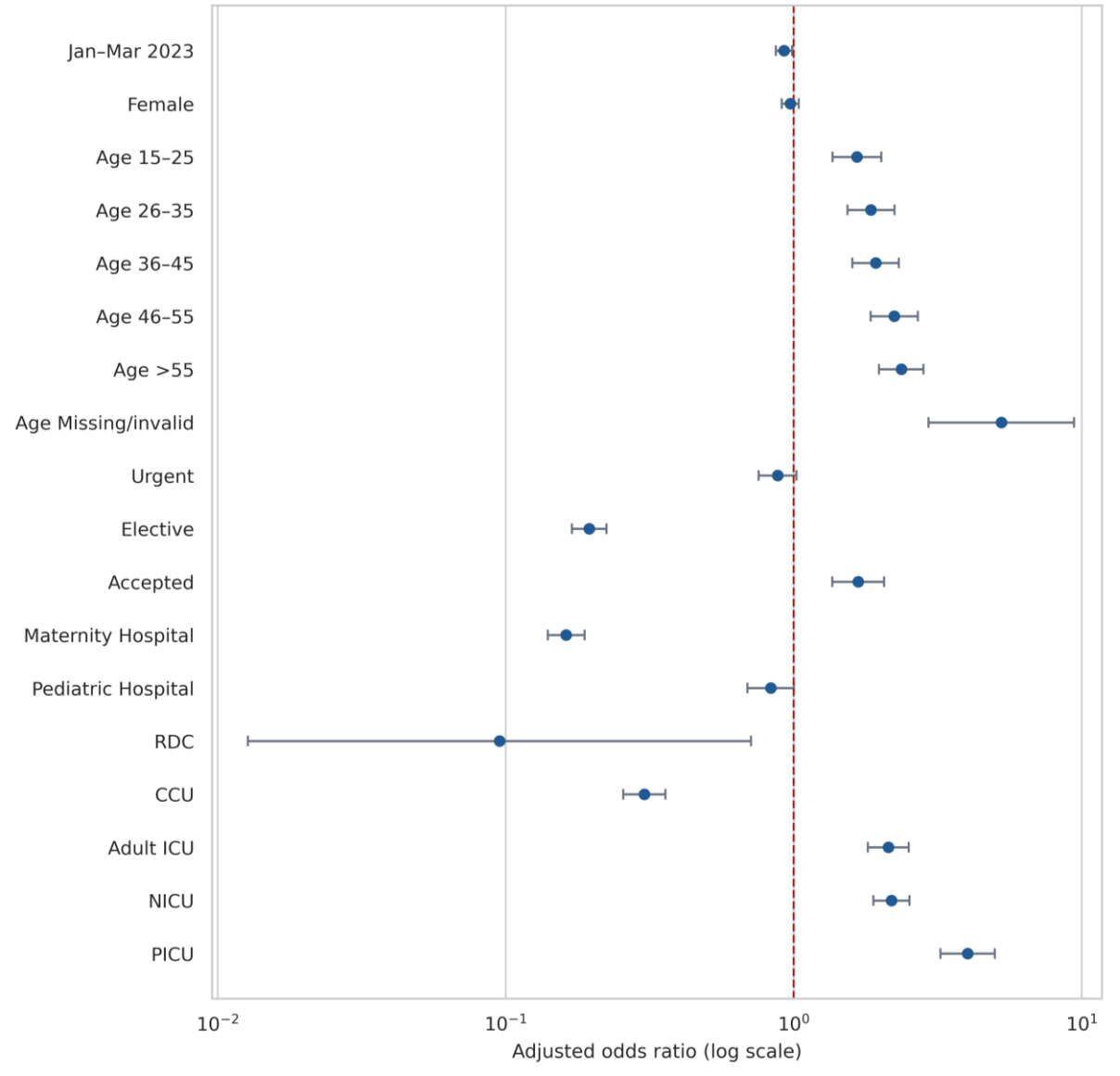


Figure 3. Adjusted predictors of prolonged length of stay (>7 days)

Discussion

This retrospective evaluation found improvement in the inpatient efficiency after full deployment of the operational programme at KSMC. In the January-March comparison, mean LOS declined by 0.31 days without statistical significance, whereas adjusted odds of stays exceeding seven days were modestly lower (aOR 0.926, 95% CI 0.869-0.987). These

02/11/2026

estimates address different outcomes: adjustment identified an association with prolonged hospitalization, while the continuous and unadjusted binary analyses did not demonstrate clear improvement. The findings warrant cautious interpretation rather than a broad claim of programme effectiveness.

The modest association is compatible with that coordinated discharge interventions produce relatively small gains. Gonçalves-Bradley et al. (13) reported a 0.73-day reduction in initial LOS and fewer readmissions in predominantly older medical patients receiving individualized discharge planning. At KSMC, earlier planning and multidisciplinary review address avoidable delays.

Abuzied et al. (14) observed a reduction in mean LOS from 9.16 to 7.47 days after multidisciplinary discharge-process improvement at King Fahad Medical City. Al Harbi et al. (15) reported a larger decline, from 11.5 to 4.4 days, following case-management implementation. These improvements exceed the present primary estimate, and differences in baseline performance, observation periods, and clinical populations limit direct comparisons. The pronounced reduction between KSMC's 2021 and 2022 datasets preceded full combined deployment and cannot establish its effect.

Changes in flow also occur without a shift in total inpatient LOS. Alotaibi et al. (16) reported reduced emergency-department boarding in six Saudi hospitals after introducing multidisciplinary teams, the SAFER bundle, visual management, and bed huddles. This indicate that future KSMC evaluations should examine discharge timing, boarding, and delays after medical readiness with LOS, because aggregate hospitalization duration incompletely represent operational performance.

Specialty-specific effects obscured when heterogeneous services are combined. In nonemergent cesarean delivery, Teigen et al. (17) found shorter postoperative LOS with enhanced recovery and no significant improvement in their primary outcomes of postoperative-day-two discharge. Their findings indicate that pathway benefits depend on the outcome assessed and do not automatically translate into earlier discharge targets.

The associations of older age and intensive care with prolonged hospitalization indicate that discharge pathways should account for clinical complexity. These variables are imperfect proxies for severity, and the model's discrimination of 0.719 does not establish adequate control of confounding. Targeting patients with persistent discharge barriers is more informative than applying uniform hospital-wide LOS targets in heterogeneous clinical services.

The lower observed mortality and higher proportion of improved discharges are encouraging, and these outcomes were not adjusted for illness severity and cannot be attributed causally to the programme. Discharge codes do not measure patient satisfaction. Jack et al. (18) show reduced subsequent hospital utilization using discharge education, medication reconciliation, appointment coordination, and pharmacist follow-up. Their trial supports assessing postdischarge outcomes when evaluating discharge redesign; the current absence of readmission and satisfaction measures prevents conclusions about transitional safety or patient experience.

02/11/2026

Strengths include the large discharge cohort, transparent exclusions, and comparison of corresponding calendar months. Limitations include the uncontrolled retrospective design, short postdeployment period, changing case mix, and unavailable diagnostic severity and comorbidity adjustment. Excluding 20.2% of the 2021 records from LOS analyses raises concerns about historical comparability. Observations could also be dependent if individuals contributed repeated admissions. Future controlled evaluations should assess implementation fidelity, distinguish component effects, and measure patient-reported experience and readmissions over longer follow-up.

Conclusion

Following full deployment of the multicomponent operational improvement programme at King Saud Medical City, adjusted odds of hospitalization exceeding seven days were modestly lower, whereas mean LOS and LOS distributions did not differ significantly between corresponding quarterly periods. Improved discharge outcomes increased and mortality decreased, but these unadjusted findings do not establish a programme effect. The uncontrolled design, changing case mix, and absence of clinical severity adjustment restrict interpretation. Longer follow-up with a comparison group, diagnostic and comorbidity adjustment, and direct assessment of patient experience and readmissions is needed to evaluate effectiveness and safety.

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