Diversifying cardiac intensive care unit models: Successful example of an operating surgeon-led unit

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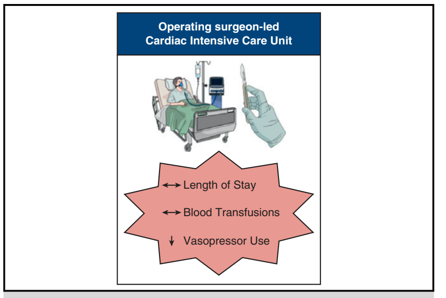
ABSTRACT

Objective: The intensivist-led cardiovascular intensive care unit model is the standard of care in cardiac surgery. This study examines whether a cardiovascular intensive care unit model that uses operating cardiac surgeons, cardiothoracic surgery residents, and advanced practice providers is associated with comparable outcomes.

Methods: This is a single-institution review of the first 400 cardiac surgery patients admitted to an operating surgeon-led cardiovascular intensive care unit from 2020 to 2022. Inclusion criteria are elective status and operations managed by both cardiovascular intensive care unit models (aortic operations, valve operations, coronary operations, septal myectomy). Patients from the surgeon-led cardiovascular intensive care unit were exact matched by operation type and 1:1 propensity score matched with controls from the traditional cardiovascular intensive care unit using a logistic regression model that included age, sex, preoperative mortality risk, incision type, and use of cardiopulmonary bypass and circulatory arrest. Primary outcome was total postoperative length of stay. Secondary outcomes included postoperative intensive care unit length of stay, 30-day mortality, 30-day Society of Thoracic Surgeons–defined morbidity (permanent stroke, renal failure, cardiac reoperation, prolonged intubation, deep sternal infection), packed red cell transfusions, and vasopressor use. Outcomes between the 2 groups were compared using chi-square, Fisher exact test, or 2-sample *t* test as appropriate.

Results: A total of 400 patients from the surgeon-led cardiovascular intensive care unit (mean age 61.2 ± 12.8 years, 131 female patients [33%], 346 patients [86.5%] with European System for Cardiac Operative Risk Evaluation II <2%) and their matched controls were included. The most common operations across both units were coronary artery bypass grafting (n = 318, 39.8%) and mitral valve repair or replacement (n = 238, 29.8%). Approximately half of the operations were performed via sternotomy (n = 462, 57.8%). There were 3 (0.2%) in-hospital deaths, and 47 patients (5.9%) had a 30-day complication. The total length of stay was significantly shorter for the surgeon-led cardiovascular intensive care unit patients (6.3 vs 7.0 days, $P = .028$), and intensive care unit length of stay trended in the same direction (2.5 vs 2.9 days, $P = .16$). Intensive care unit readmission rates, 30-day mortality, and 30-day morbidity were not significantly different between cardiovascular intensive care unit models. The surgeon-led cardiovascular intensive care unit was associated with fewer postoperative red blood cell transfusions in the cardiovascular intensive care unit ($P = .002$) and decreased vasopressor use ($P = .001$).

Conclusions: In its first 2 years, the surgeon-led cardiovascular intensive care unit demonstrated comparable outcomes to the traditional cardiovascular intensive care unit with significant improvements in total length of stay, postoperative transfusions in the cardiovascular intensive care unit, and vasopressor use. This early success exemplifies how an operating surgeon-led cardiovascular intensive care unit can provide similar outcomes to the standard-of-care model for patients undergoing elective cardiac surgery. (JTCVS Open 2023;16:524-31)



Operating surgeon-led unit had similar outcomes to the traditional model.

CENTRAL MESSAGE

An operating surgeon-run intensive care unit is an effective care model for postoperative cardiac surgery care.

PERSPECTIVE

The intensivist-led CICU is the gold standard for cardiac surgery. Although successful, this model is not always feasible to replicate in variably resourced settings, and further diversity in model structure may help meet increased surgical demand. This study demonstrates the early success of an alternative operating surgeon-led unit, which was associated with comparable outcomes.

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Abbreviations and Acronyms

APP	= advanced practice provider
CICU	= cardiac intensive care unit
euroSCORE	= European System for Cardiac Operative Risk Evaluation
LOS	= length of stay
OR	= odds ratio
pRBC	= packed red blood cells
sl-CICU	= surgeon-led cardiac intensive care unit
t-CICU	= traditional cardiac intensive care unit

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Tasked with taking care of some of the most critically ill patients in the hospital, the cardiac intensive care unit (CICU) cardiac intensive care unit must be well equipped to manage acute issues related to hemodynamic and ventilatory support, end-organ damage, bleeding, and perioperative care.[1] In most institutions, the traditional CICU (t-CICU) model uses in-house intensivists with critical care training who run a team of resident physicians from various disciplines and advanced practice providers (APPs).[2]

With the recent expansion of our hospital in 2019 came an increasing bed capacity issue and a welcomed opportunity to revisit the CICU model. In collaboration with hospital leadership involving nurses, APPs, intensivists, and cardiothoracic surgeons, an operating surgeon-led CICU (sl-CICU) model was envisioned, and after several months of preparation, one of the step-down units was converted to a fully functional sl-CICU in late 2020. The objective of this study was to compare outcomes of the first 400 patients in this new sl-CICU with the t-CICU.

MATERIAL AND METHODS

Study Design

A retrospective single-center review of the first 400 cardiac surgery patients admitted to a newly opened operating sl-CICU at our institution from 2020 to 2022 was performed after approval by the Institutional Review Board of the study protocol and publication of data (Institutional Review Board 59,157; granted February 22, 2022). A waiver of consent was granted given the use of deidentified data. Patients from the sl-CICU were the comparison group. Patients aged more than 18 years who underwent elective or urgent cardiac surgical operations managed by both CICU models (aortic operations, valve operations, coronary operations, septal myectomy) were included. Exclusion criteria included crossover patients and cases that accounted for less than 1% of total cases (eg, pulmonary valve intervention, pericardiectomy, atrial septal defect closure). The control population included all cardiac surgery patients within the inclusion criteria who went to the t-CICU from 2015 to 2022. All data were collected from available electronic or written medical records. Medical records were reviewed for preoperative, intraoperative, and postoperative details, including comorbidities, operative characteristics, and complications. Complications were considered over the entire postoperative stay.

Operating Surgeon-led and Traditional Cardiac Intensive Care Unit Model Structures

The sl-CICU currently has 12 beds and is run by an operating cardiothoracic surgeon who manages 2 APPs during the day shift and 2 APPs during the night shift. For approximately half of the year, a junior cardiothoracic surgery resident rotates on the service and serves as 1 of the 2 providers staffed for the day shift. Patients requiring extracorporeal cardiopulmonary support (eg, extracorporeal membrane oxygenator, ventricular assist device) were not accepted during the study period. Notably, the operating cardiac surgeons who run this unit include all faculty members in the department with operative clinical practices, many of whom are high-volume surgeons (>200 cases per year). During the week in which they serve as CICU attending, they are not operating and are available in the CICU full-time.

In contrast, the t-CICU model has 24 beds and is run by 2 critical care-trained intensivists. Each runs a team of 1 to 3 providers, consisting of a mixture of critical care fellows, residents from a range of medical and surgical specialties, and staff APPs. The APPs in both CICUs are selected from the same pool and alternate shifts between units. Nursing ratios are equal for the CICU models, but the nursing staff are not from the same pool. Whereas the t-CICU uses nurses who have regularly worked in the CICU, the sl-CICU trained nurses are from different units (ie, cardiac care unit, noncardiac ICU) over the transition period to be able to care for the sl-CICU patients as soon as possible.

In terms of workflow structure, both units have separate day-shift and night-shift provider teams who round on patients at the start of shift with nurses, the attending physician, and auxiliary staff when able (eg, pharmacist, social worker, therapy services). Although the t-CICU providers comanage patients with the primary cardiac surgery attending, the sl-CICU bypasses this additional step in communication.

Statistical Analysis

Patients admitted to the sl-CICU were matched 1:1 to t-CICU patients. Exact matching was performed on operation type (11 binary indicators for aortic root replacement, ascending aorta replacement, aortic arch replacement, coronary artery bypass grafting, myocardial bridge unroofing, aortic valve intervention, tricuspid valve intervention, mitral valve intervention, thoracic endovascular aortic repair, and septal myectomy). We then fit a regression model for admission to the sl-CICU using logistic regression to produce a propensity score using optimal pairwise matching ("matchit" R package, version 4.3.2). The propensity score model included covariates for age, sex, incision type, preoperative risk (European System for Cardiac Operative Risk Evaluation [euroSCORE] II <2% = low, 2%-5% = medium, ≥5% = high), use of cardiopulmonary bypass (binary), and use of circulatory arrest (binary). Covariate balance was assessed using standardized mean differences between groups, with a difference of less than 0.1 deemed acceptable.[3]

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TABLE 1. Patient characteristics by cardiac intensive care unit model before and after matching (n = 800 patients)

Characteristic (units)	Overall (n = 800)*	sl-ICU (n = 400)*	t-ICU, matched (n = 400)*	t-ICU, unmatched (n = 3027)*
Age (y)	60.9 (13.1)	61.2 (12.8)	60.6 (13.4)	62.3 (13.9)
Sex–n (%)				
Female	258 (32.2%)	131 (32.8%)	127 (31.8%)	986 (32.6%)
Male	542 (67.8%)	269 (67.2%)	273 (68.2%)	2041 (67.4%)
Risk type–n (%)				
Low	679 (84.9%)	346 (86.5%)	333 (83.2%)	1894 (62.6%)
Medium	104 (13.0%)	50 (12.5%)	54 (13.5%)	680 (22.5%)
High	17 (2.1%)	4 (1.0%)	13 (3.2%)	453 (15.0%)
Aortic root replacement–n (%)	48 (6.0%)	24 (6.0%)	24 (6.0%)	667 (22.0%)
Ascending aorta replacement–n (%)	42 (5.2%)	21 (5.2%)	21 (5.2%)	501 (16.6%)
Arch replacement–n (%)	18 (2.2%)	9 (2.2%)	9 (2.2%)	370 (12.2%)
AVR–n (%)	104 (13.0%)	52 (13.0%)	52 (13.0%)	1188 (39.2%)
TVR–n (%)	22 (2.8%)	11 (2.8%)	11 (2.8%)	301 (9.9%)
MVR–n (%)	238 (29.8%)	119 (29.8%)	119 (29.8%)	940 (31.1%)
CABG–n (%)	318 (39.8%)	159 (39.8%)	159 (39.8%)	817 (27.0%)
TEVAR–n (%)	60 (7.5%)	30 (7.5%)	30 (7.5%)	40 (1.3%)
Myocardial bridge unroofing–n (%)	76 (9.5%)	38 (9.5%)	38 (9.5%)	102 (3.4%)
Septal myectomy–n (%)	16 (2.0%)	8 (2.0%)	8 (2.0%)	92 (3.0%)
Incision type–n (%)				
Mini	260 (32.5%)	130 (32.5%)	130 (32.5%)	551 (18.2%)
Percutaneous	55 (6.9%)	29 (7.2%)	26 (6.5%)	26 (0.9%)
Port	23 (2.9%)	11 (2.8%)	12 (3.0%)	26 (0.9%)
Sternotomy	462 (57.8%)	230 (57.5%)	232 (58.0%)	2424 (80.1%)
CPB use–n (%)	641 (80.1%)	318.0 (79.5%)	323 (80.8%)	2867 (94.7%)
CPB time (min)	107.2 (58.2)	101.9 (48.6)	112.3 (65.9)	153.0 (87.7)
Crossclamp time (min)	75.7 (44.0)	72.7 (38.8)	78.7 (48.4)	105.9 (65.1)
Circulatory arrest use–n (%)	16 (2.0%)	7 (1.8%)	9 (2.2%)	370 (12.2%)
Circulatory arrest time (min)	27.8 (15.7)	21.1 (5.0)	33.0 (19.4)	36.4 (30.0)

Patient characteristics for both CICU models before and after matching. Notably, there was no significant difference characteristics between the 2 CICU models after matching ($P > .05$). *sl-ICU,* Operating surgeon-led intensive care unit; *t-ICU,* traditional intensive care unit; *AVR,* aortic valve replacement or repair; *TVR,* tricuspid valve replacement or repair; *MVR,* mitral valve replacement or repair; *CABG,* coronary artery bypass grafting; *TEVAR,* thoracic endovascular aortic repair; *CPB,* cardiopulmonary bypass. *Mean (SD); n (%).

Descriptive analysis of baseline characteristics was undertaken, with continuous variables reported as mean and SD, or median with interquartile range as appropriate, and categorical variables reported as total and relative frequencies. Primary outcome was total postoperative length of stay (LOS). Secondary outcomes included postoperative ICU LOS, 30-day mortality, 30-day STS-based morbidity (permanent stroke, renal failure, cardiac reoperation, prolonged intubation, deep sternal infection),[4] total and CICU postoperative packed red blood cell (pRBC) transfusions, and postoperative ICU vasopressor use. Total vasopressor use was calculated as area under the curve by integrating the rate of administration over hours of administration. To account for variety of vasopressors used, all vasopressors were converted to norepinephrine equivalents.[5] Outcomes between the 2 groups were compared using chi-square, Fisher exact test, or 2-sample *t* test as appropriate.

RESULTS

Patient Characteristics

At a mean age 61.2 ± 12.8 years, patients admitted to the sl-CICU were predominantly of low preoperative risk (86.5%, n = 346, Table 1). The majority were male (67.2%, n = 269). The most common procedures were coronary artery bypass grafting (39.8%, n = 159) and mitral valve repair or replacement (29.8%, n = 119). Other procedures included, nonexclusive, aortic valve repair or replacement (13%, n = 52), myocardial bridge unroofing (9.5%, n = 38), thoracic endovascular aortic replacement (7.5%, n = 30), aortic root replacement (6%, n = 24), ascending aorta replacement (5.2%, n = 21), tricuspid valve repair or replacement (2.8%, n = 11), aortic arch replacement (2.2%, n = 9), and septal myectomy (2%, n = 8). Regarding incision type, approximately half of patients underwent sternotomy (57.5%, n = 230), and 32.5% of patients (n = 130) underwent minithoracotomy or ministernotomy. Approximately 80% of patients (n = 318) underwent cardiopulmonary bypass, with an average time of 101.9 ± 48.6 minutes. Average crossclamp time was

TABLE 2. Clinical outcomes by cardiac intensive care unit model (n = 800 patients)

Outcome (units)	Overall (n = 800)*	sl-ICU (n = 400)*	t-ICU (n = 400)*	Linear regression coefficient [95% CI]	P value
ICU LOS (d)	2.7 (2.8)	2.5 (2.0)	2.9 (3.3)	−0.25 [–0.59 to 0.09]	.16
Total LOS (d)	6.7 (4.4)	6.3 (4.0)	7.0 (4.8)	**−0.6 [–1.13 to –0.07]**	**.028**
Total postoperative pRBCs (unit)	0.6 (1.5)	0.5 (1.2)	0.6 (1.7)	−0.12 [–0.31 to 0.07]	.21
ICU postoperative pRBCs (unit)	0.4 (1.3)	0.3 (0.8)	0.6 (1.6)	**−0.26 [–0.44 to –0.09]**	**.002**
Total pressors (μ g/kg)	80.7 (196.2)	56.9 (86.9)	104.5 (261.5)	**−43 [–69.4 to –16.7]**	**.001**
Total pressors/ICU hour (μ g/kg/h)	0.8 (1.7)	0.7 (0.9)	1.0 (2.3)	**−0.33 [–0.57 to –0.09]**	**.007**
Outcome–n (%)	**Overall (n = 800)***	**sl-ICU (n = 400)***	**t-ICU (n = 400)***	**OR [95% CI]**	**P value**
ICU readmission	14 (1.8%)	4 (1.0%)	10 (2.5%)	0.4 [–0.83 to 1.63]	.14
30-d mortality	3 (0.4%)	1 (0.2%)	2 (0.5%)	0.87 [–1.81 to 3.55]	.91
30-d morbidity	47 (5.9%)	19 (4.8%)	28 (7.0%)	0.67 [0.01-1.33]	.23
Permanent stroke	9 (1.1%)	4 (1.0%)	5 (1.2%)	0.58 [–0.98 to 2.14]	.50
Renal failure	7 (0.9%)	4 (1.0%)	3 (0.8%)	1.2 [–0.43 to 2.84]	.82
Cardiac reoperation	9 (1.1%)	2 (0.5%)	7 (1.8%)	0.26 [–1.52 to 2.05]	.14
Prolonged intubation	27 (3.4%)	10 (2.5%)	17 (4.2%)	0.48 [–0.41 to 1.37]	.11
DSWI	5 (0.6%)	2 (0.5%)	3 (0.8%)	0.66 [–1.31 to 2.63]	.68
Postoperative RBC received	197 (24.6%)	86 (21.5%)	110 (27.8%)	0.71 [0.35-1.07]	.066

Clinical outcomes for both cardiovascular intensive care unit models, and regression modeling results comparing outcomes between t-ICU and sl-ICU patients. Each outcome was regressed separately on the binary indicator for t-ICU versus sl-ICU as well as all covariates used for matching. Linear regression coefficients and ORs are reported for continuous and binary outcomes respectively. Significant values in bold text. *sl-ICU,* Operating surgeon-led intensive care unit; *t-ICU,* traditional intensive care unit; *LOS,* length of stay; *pRBC,* packed red blood cell transfusion; *ICU*, intensive care unit; *OR*, odds ratio; *DSWI,* deep sternal wound infection; *RBC,* red blood cell. *Mean (SD); n (%).

72.7 ± 38.8 minutes. Circulatory arrest was used in 7 patients (1.8%), with an average time of 21.1 ± 5.0 minutes.

Matching

All 400 patients from the sl-CICU were exact matched with patients from our t-CICU for procedure type and then 1:1 propensity score matched using a logistic regression model with preoperative and intraoperative covariates. The control t-CICU population used for matching consisted of 3027 patients who underwent cardiac surgery between 2015 and 2022. After matching, the standardized mean difference across all variables except high preoperative risk was reduced to below 0.1 (Figure E1), suggesting good covariate balance between the 2 groups. Furthermore, there was no significant difference in age, sex, preoperative risk, operation type, incision type, use of cardiopulmonary bypass, bypass time, crossclamp time, use of circulatory arrest, or circulatory arrest time between the 2 CICU models ($P > .05$, Table 1).

Postoperative Outcomes

Primary outcome of total postoperative hospital LOS was significantly shorter for the sl-CICU (6.3 vs 7.0 days, coefficient −0.6, $P = .028$, Table 2). CICU-specific LOS trended toward being shorter in the sl-CICU, but the difference was not significant (2.5 vs 2.9 days, coefficient −0.25, $P = .16$). CICU readmission rates were not significantly different, with 4 (1.0%) for the sl-CICU and 10 (2.5%) for the t-CICU.

Morbidity and mortality rates were low for both CICU models, with an overall 30-day mortality rate of 0.4% (n = 3) and 30-day STS morbidity rate of 5.9% (n = 47). There was no significant difference between the 2 models for 30-day mortality ($P = .92$) or overall morbidity ($P = .23$). Although data trended toward improved rates of cardiac reoperation (odds ratio [OR], 0.26, $P = .14$) and prolonged intubation (OR, 0.48, $P = .11$) for the sl-CICU, ultimately all independent measures of 30-day morbidity were not significantly different between the 2 models.

Although the total number of postoperative pRBC transfusions was not significantly different between the 2 CICU models ($P = .21$), the number of CICU-specific blood transfusions (coefficient −0.26, $P = .002$) was significantly lower for the sl-CICU. Use of postoperative pRBC transfusions by patient also trended lower for the sl-CICU group but was not significant (86 vs 110 patients, OR, 0.71, $P = .066$). Total vasopressor use was significantly lower for the sl-CICU group (56.9 vs 104.5 μ g/kg, coefficient −43, $P = .001$). This difference persisted after normalizing by total hours in the CICU (0.7 vs 1.0 μ g/kg/h, coefficient −0.33, $P = .007$).

DISCUSSION

Many institutions including our own use a traditional intensivist-led CICU model for the postoperative care of cardiac surgery patients, citing studies that have shown favorable outcomes with this model structure.[2,6-8] In

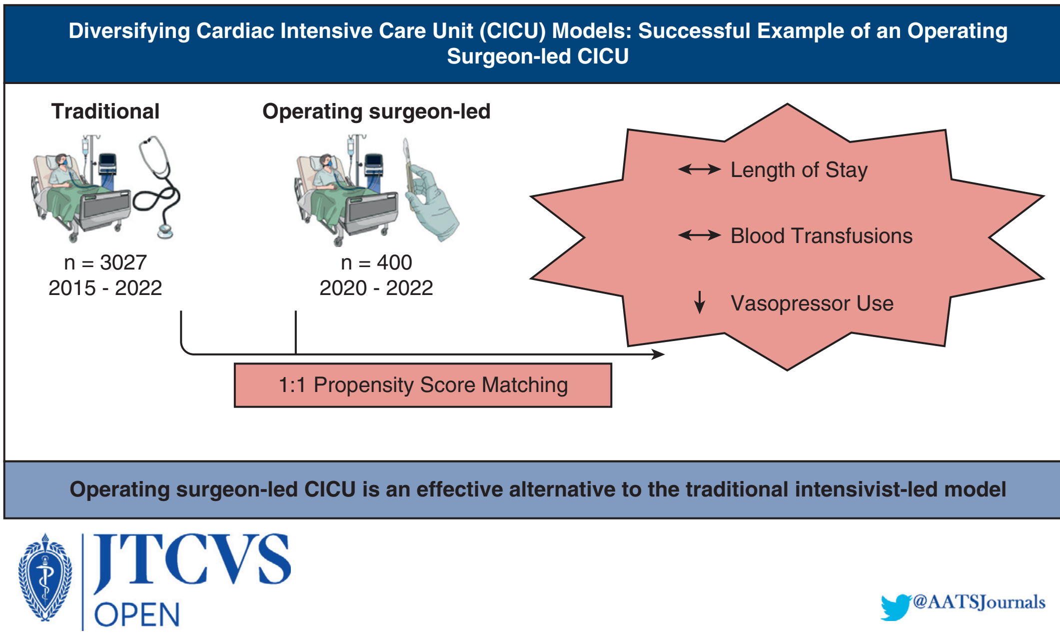

FIGURE 1. In its first 2 years, a newly opened operating surgeon–led CICU had equivalent outcomes for LOS and blood transfusion administration and was associated with decreased vasopressor use compared with a matched cohort from the traditional intensivist-led CICU model. These results support the feasibility of an operating surgeon-led CICU and the importance of diversifying CICU models. *CICU*, Cardiac intensive care unit.

certain situations, however, replicating this model may not be feasible to accommodate an increased demand in surgical volume with increased staffing pressures for intensivists, and a need for model diversification may be necessary.[9] The early-stage results from the current study demonstrate both the feasibility and the potential efficacy of such an effort. Indeed, in its first 2 years of operation, the new operating sl-CICU demonstrated equivalent measures of postoperative mortality and morbidity with improved total hospital LOS, reduced administration of pRBC transfusions in the CICU, and decreased vasopressor use compared to our current CICU model (Figure 1).

This study was not powered or designed to make claims of superiority, but rather simply to assess whether the new operating surgeon-led model offered similar outcomes for the subgroup of patients cared for in both units. The 2 CICU models differed in their capabilities at the time of the study, with the sl-CICU (1) not yet accepting patients requiring mechanical circulatory support, (2) accepting patients with euroSCORE II risk of mortality more than 5% only midway during the study period, and (3) nurses being less experienced that those in the t-CICU at the initial stages of the study period. Thus, direct comparison was challenging. Statistical efforts at matching within the selected patient groups, however, were rigorous, giving confidence to the observed results.

Regarding shorter total hospital LOS observed in the sl-CICU group, this trend was not significant for the secondary outcome of ICU-specific LOS. Therefore, it is difficult to make a convincing claim that the sl-CICU decreased LOS for patients at this time. However, the trend was still present, so this may represent a power issue, and it will be important to follow up in future studies.

Notably, the sl-CICU was associated with significantly decreased postoperative transfusion and vasopressor administration. Given the preoperative risk factors and intraoperative risk measures (ie, bypass and crossclamp times) were well balanced between groups, these differences are notable. The exact etiology of these differences is difficult to ascertain given the current study design. Because this is not a randomized study and preoperative risk for postoperative vasoplegia was not controlled for (eg, use of angiotensin-converting-enzyme inhibitors), it is possible there may be imbalance between groups regarding perioperative vasoplegia. Given the sl-CICU workflow obviates the need for further intergroup discussions before making management changes (ie, titrating down vasopressors), it is also possible this decreased latency between surgeon preference and actionable change can in part explain the observed results, especially given the short CICU stay for the study population. Indeed, a difference of several hours to titrate down pressors would be significant in the current study. Another possible explanation for the observed difference in vasopressor use is data entry methodology. Namely, vasopressor dosage was input manually up until early 2019, when pumps were transitioned to automatic entry. Because manual entry was only present in the t-CICU, it is possible that user error can account in part for the differences observed. It is also reasonable to posit that the decreased amount of vasopressors used in the sl-CICU may in part explain the trend toward decreased LOS.

Prior studies have demonstrated an association between postoperative LOS and transfusion administration.[10-13] However, because total units of transfusion administration and number of patients who received transfusions did not significantly differ between units, it is unclear if this played a role in the current study. Although studies have shown increased morbidity or mortality risk with increased postoperative transfusion and vasopressor use,[11,14] there was no discernible difference in mortality or morbidity between the CICU models in the current study.[15] This points to the validity of both models as a safe and effective environment to take care of critically ill postoperative cardiac surgery patients. Further study is warranted to investigate the etiology and significance of using fewer transfusions and vasopressors in the sl-CICU.

Study Limitations

Because this study examines the first 400 patients admitted to the sl-CICU, there were several ongoing policy adjustments during this phase. For example, the sl-CICU only started out with 6 beds for the first 100 patients and gradually upscaled to the 12 beds currently in use. As aforementioned, criteria for admission to the sl-CICU were also liberalized from euroSCORE II less than 5% to 5% or more midway in the study period. Because patients assigned to the t-CICU and sl-CICU were not randomized, assignment is subject to selection bias. However, matching across preoperative risk and intraoperative measures such as bypass and crossclamp time should minimize this bias. Furthermore, in the initial stages of the sl-CICU, bed allocation for downgrading to the floor was often prioritized for patients in the t-CICU during the overlap period, which may have affected ICU-specific LOS. Although the study population was predominantly composed of low-risk elective patients and excluded transplant recipients and patients on mechanical circulatory support, this population represents the majority of patients undergoing cardiac surgery and therefore is applicable to most settings. Nonetheless, because the sl-CICU has begun to take on more complex and high-risk patients, it will be important to analyze in future studies whether outcomes are affected in a higher-risk study population.

CONCLUSIONS

The present study highlights a successful example of transforming a stepdown unit into an operating cardiothoracic sl-CICU with equivalent outcomes to our current t-CICU model in its first 2 years. It is a testament to how multidisciplinary efforts at diversifying care models can be efficiently and successfully used even in the acute setting of a CICU. Moving forward, as the sl-CICU takes on more advanced patients and continues to expand bed capacity, it will be important to continue to document progress and outcomes.

Webcast

You can watch a Webcast of this AATS meeting presentation by going to: https://www.aats.org/resources/diversifying-cardiac-intensive-care-unit-models-successful-example-of-an-operating-surgeon-led-unit.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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Key Words: cardiac intensive care unit, intensivist, operating surgeon, perioperative care, transfusion, vasopressor

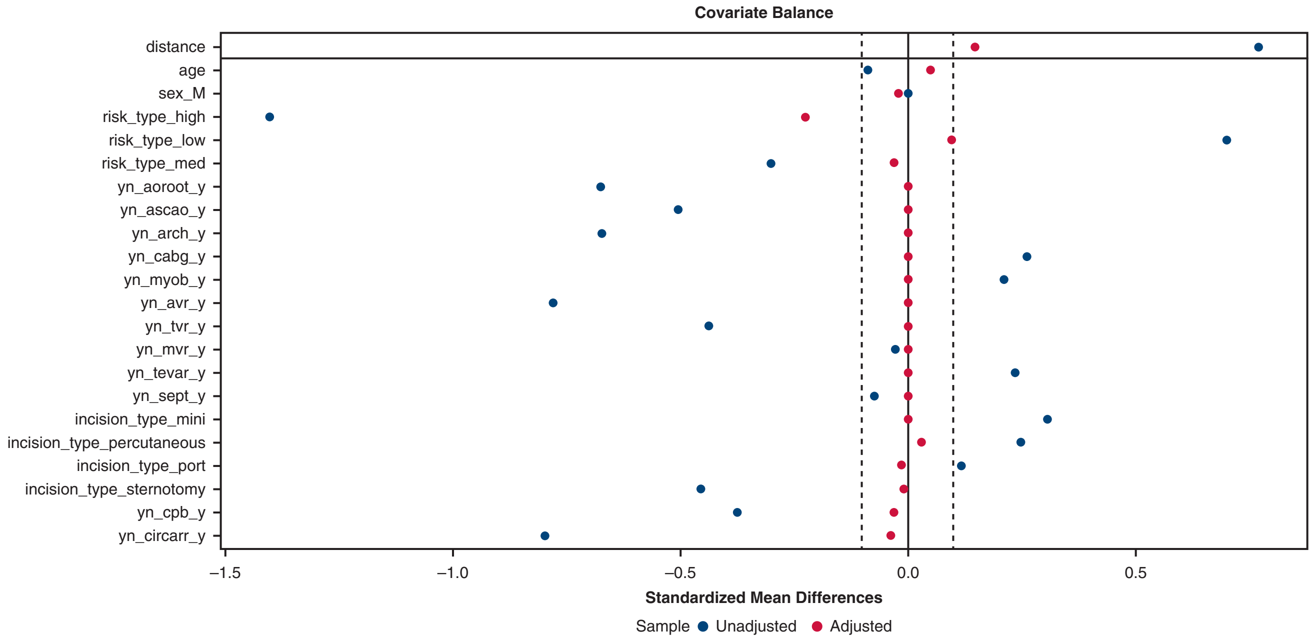

FIGURE E1. Depiction of covariate balance and standardized mean differences across characteristics. *Dotted lines* represent values −0.1 and 0.1. *Blue dots* correspond to unadjusted, prematching values, and *red dots* to adjusted, postmatching values. All covariates except high preoperative risk type were within this range, suggesting good balance between groups postmatching.