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ORIGINAL RESEARCH

Do patient outcomes differ when the trauma team leader is a surgeon or non-surgeon? A multicentre cohort study

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Abstract

Purpose Trauma team leaders (TTLs) have traditionally been general surgeons; however, some trauma centres use a mixed model of care where both surgeons and non-surgeons (primarily emergency physicians) perform this role. The objective of this multicentre study was to provide a well-powered study to determine if TTL specialty is associated with mortality among major trauma patients.

Methods Data were collected from provincial trauma registries at six level 1 trauma centres across Canada over a 10-year period. We included adult trauma patients (age ≥ 18 yrs) who triggered the highest-level trauma activation. The primary outcome was the difference in risk-adjusted in-hospital mortality for trauma patients receiving initial care from a surgeon versus a non-surgeon TTL.

Results Overall, 12,961 major trauma patients were included in the analysis. Initial treatment was provided by a surgeon TTL in 57.8% ($n=7513$) of cases, while 42.2% ($n=5448$) of patients were treated by a non-surgeon TTL. Unadjusted mortality occurred in 11.6% of patients in the surgeon TTL group and 12.7% of patients in the non-surgeon TTL group (OR 0.87, 95% CI 0.78–0.98, $p=0.02$). Risk-adjusted mortality was not significantly different between patients cared for by surgeon and non-surgeon TTLs (OR 0.92, 95% CI 0.80–1.06, $p=0.23$). Furthermore, we did not observe differences in risk-adjusted mortality for any of the subgroups evaluated.

Conclusions After risk adjustment, there was no difference in mortality between trauma patients treated by surgeon or non-surgeon TTLs. Our study supports emergency physicians performing the role of TTL at level 1 trauma centres.

Keywords Wounds and injuries · Multiple trauma · Emergency medicine · Trauma Centers

Abstrait

Objectif Les chefs d'équipe de traumatologie (CET) sont traditionnellement des chirurgiens généralistes; cependant, certains centres de traumatologie utilisent un modèle mixte de soins où des chirurgiens et des non-chirurgiens (principalement des médecins d'urgence) qui jouent ce rôle. L'objectif de cette étude multicentrique était de fournir une étude bien menée pour déterminer si la spécialité CET est associée à la mortalité chez les patients traumatisés majeurs.

Méthodes Les données ont été recueillies à partir des registres provinciaux de 6 niveau 1 centres de traumatologie au Canada sur une période de 10 ans. Nous avons inclus des patients adultes traumatisés (âge ≥ 18 ans) qui ont provoqué l'activation traumatique de niveau le plus haut. Le primaire résultat était la différence de mortalité hospitalière ajustée en fonction du risque pour les patients traumatisés qui ont reçu des soins primaires d'un chirurgien par rapport à un CET non chirurgien.

Résultats En totale, 12 961 patients traumatisés majeurs ont été la partie de cette analyse. Le soin primaire a été assuré par un chirurgien CET dans 57,8 % (n=7 513) des cas, alors que 42,2 % (n=5 448) des patients ont été traités par un CET non chirurgien. Une mortalité non ajustée s'est produit chez 11,6 % des patients du groupe de chirurgien CET et 12,7 % des

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patients du groupe de non chirurgien CET (OR 0,87, IC à 95 % 0,78 à 0,98, p = 0,02). La mortalité ajustée en fonction du risque n'était pas significativement différente entre les patients pris en charge par des CET chirurgiens et non-chirurgiens (RC 0,92, IC à 95 % 0,80 à 1,06, p = 0,23). De plus, nous ne pouvons pas observer de différences de mortalité ajustée au risque pour aucun des sous-groupes évalués.

Conclusions Après avoir ajusté du risque, il n'y avait pas de différence de mortalité entre les patients traumatisés traités par des chirurgiens ou non chirurgiens CET. Notre étude soutient les médecins d'urgences jouent le rôle de CET dans les centres de traumatologie de niveau 1.

Mots-clés Blessures · Traumatisme multiple · Médecine d'urgence · Centres de traumatologie

Clinician's capsule

What is known about the topic?
There is ongoing debate regarding whether a trauma team should be led by a surgeon or non-surgeon.

What did this study ask?
Are there differences in patient outcomes if a trauma team is led by a surgeon or non-surgeon?

What did this study find?
This multicentre study found no difference in risk-adjusted trauma patient mortality for cases led by non-surgeon TTLs vs surgeon TTLs.

Why does this study matter to clinicians?
Both surgeons and non-surgeons can effectively lead a trauma team with no compromise to the quality of care.

Introduction

Trauma care has improved immensely in recent decades and mortality rates for major trauma patients have progressively declined in developed countries [1]. Level 1 trauma centres have dedicated trauma teams that provide care for the most severely injured patients [1–5]. Studies have demonstrated that an organized trauma team improves outcomes from the initial assessment and resuscitation of trauma patients [6–8]. The trauma team is guided by a trauma team leader (TTL) who coordinates the resuscitation, ensuring each phase of care flows in continuity and Advanced Trauma Life Support guidelines are adhered to [9, 10]. The American College of Surgeons recommends surgeons act as TTL [9]; however, existing evidence suggests anyone trained in trauma management including non-surgical specialists can safely perform the TTL role [11–23]. In Canada, the TTL role has been performed by non-surgeons over the past several decades [24, 25].

Few studies have compared outcomes between trauma patients receiving care from surgeon TTLs versus non-surgeon TTLs [11, 12, 26]. Most have been performed in Canada where subspecialty surgeons and non-surgical specialists (primarily emergency medicine but also anaesthesia, internal medicine and critical care) act as TTL. While existing evidence demonstrates no difference in survival or length of stay in the ED or in-hospital [11, 12], Leeper and colleagues reported increased odds of missed injury when the TTL is a non-surgeon [17]. Previous studies were underpowered to detect a difference in outcomes [26].

Blunt torso trauma is increasingly becoming a non-surgical disease; patients managed operatively in the past are now selectively managed non-operatively [22, 23, 27–29]. Given that many Canadian centres include both surgeon and non-surgeon TTLs, a pan-Canadian multicentre study would be sufficiently powered to detect a difference in trauma outcomes between cases led by surgeon versus non-surgeon TTLs. Our primary objective was to compare in-hospital mortality between major trauma patients receiving initial care by surgeon or non-surgeon TTLs using unadjusted mortality and predicted versus actual mortality. Secondary objectives were to examine differences in pre-defined patient subgroups including blunt trauma, penetrating trauma, hypotensive patients, and patients with head, thoracic, or abdominal injuries. We also assessed for associations between TTL specialty and ED survival, intensive care unit (ICU) length of stay, and hospital length of stay.

Methods

Study design and setting

We conducted a multicentre retrospective cohort study utilizing data from trauma registries at six level 1 trauma centres in three provinces across Canada (Supplementary Material 6). To control for confounders within each site that could affect patient outcomes, we only included trauma centres where both surgeons and non-surgeons function as TTL.

TTL schedules were pre-determined prior to patient arrival and should not be affected by patient characteristics. Both surgeon and non-surgeon TTLs could potentially work all shifts at each site and all TTLs were clinicians experienced in caring for severely injured trauma patients and competent in all resuscitative procedures outlined in ATLS. Prior to data acquisition, we were unaware of any systematic biases by which call schedules were created. This study is reported in accordance with STROBE guidelines.

Population

For each site, we collected the ten most recent years of data available in their trauma registry; injury dates ranged from 2006 to 2019. We included all trauma patients who were part of the highest-level trauma activation, age ≥ 18 years, and with an injury severity score (ISS) ≥ 9 for penetrating traumas or an ISS ≥ 12 for blunt traumas. We excluded patients who arrived without vital signs, had major burns greater than 20% total body surface area and patients with a pre-existing Do Not Resuscitate order. Pregnant trauma patients were included.

We defined head injuries as an Abbreviated Injury Scale (AIS) Head ≥ 3, thoracic injuries as an AIS Thorax ≥ 3, and abdominal injuries as an AIS Abdomen ≥ 3. Hypotensive patients were defined as those who arrived in the ED with a systolic blood pressure < 90 mmHg. Patient arrivals were categorized as daytime (7:00 a.m.–4:59 p.m.) and nighttime (5:00 p.m.–6:59 a.m.).

Measurements

At each site, study investigators categorized TTLs as surgeon or non-surgeon based on training and certification. The remaining data were extracted from provincial trauma registries and compiled into a single study database in accordance with privacy, data sharing agreements, and ethics board requirements at each participating institution. Trauma registry data are collected from all trauma centres, coded according to provincial standards, and subject to rigorous data quality checks to ensure a high level of integrity and consistency [30, 31]. Data merging and cleaning was performed by a trained registry analyst and verified by two statisticians. We collected data on patient demographics (age, sex), mechanism of injury (blunt, penetrating), specific mechanism of injury (motor vehicle collision, fall, assault, gunshot wound, stab, etc.), ISS, maximum AIS for each body region, AIS severity scores, ICD-10-CA codes for calculating comorbidity index, vital signs (pre-hospital, receiving facility) including heart rate, blood pressure, respiratory rate, temperature, oxygen saturations, shock index (heart rate/systolic blood pressure), Glasgow Coma Scale (GCS) score (pre-hospital, receiving facility), and intubation (pre-hospital, ED, operating room, ICU or any other location).

Without knowing the ratio of surgeon to non-surgeon managed cases in the final sample, we conducted multiple sample size calculations based on different possible ratios and chose to use the most conservative estimate (Online Resource 1). Based on an estimated in-hospital mortality rate of 15% from previous studies in similar populations [11, 32], a mortality difference of 2%, a power of 80% and a surgeon to non-surgeon ratio of 1:1.5, we calculated a total of 11,238 cases would be required. We anticipated that a 10-year study period would be required to achieve this sample size and to maximize power for subgroup analyses.

Outcomes

The primary outcome of interest was in-hospital mortality. Additional hypothesis-generating outcomes of interest included ED mortality, ICU length of stay, and hospital length of stay.

Analysis

We used an alpha of 0.05 and two-tailed tests for all analyses. Descriptive statistics were summarized by group (surgeon or non-surgeon TTL cases) for baseline characteristics. Categorical variables (sex, mechanism of injury, ISS) were summarized as frequencies and percentages. Continuous variables (age, GCS, systolic blood pressure, shock index, hospital length of stay) were summarized as medians with interquartile range (IQR) limits. We used the Mann–Whitney *U* test to compare hospital and ICU length of stay, and Chi-square analysis to compare daytime versus nighttime arrivals. Assuming each site has different ratios of cases led by surgeon and non-surgeon TTLs, as well as differing mortality rates, we performed unadjusted mortality analyses by calculating site-specific odds ratios and then combining the weighted odds ratios for a pooled odds ratio for all sites. We did this to ensure the effect of TTL type on patient mortality would only be compared within sites and not between sites. We also performed a risk-adjusted mortality analysis via multiple linear and hierarchal logistic regression, employing the trauma risk-adjusted model (TRAM) methodology [31], which includes indicators of anatomic injury severity, most severely injured body region, physiological response to injury, and physiological reserve (Online Resource 2).

Subgroups included patients with blunt trauma, traumatic brain injury defined as AIS Head ≥ 3, thoracic injury, abdominal injury, hypotension (systolic blood pressure < 90 mmHg), or a shock index > 1. For secondary analyses, we presented descriptive statistics alone with the exception of the Chi-squared analysis for day and night-time arrival. Any patients with missing data on mortality were excluded. Patients with missing subgroup data were excluded from subgroup analysis but included in the primary outcome analysis. To account for missing values for vital signs, we simulated the data with multiple imputations using the Markov chain Monte Carlo method.

Results

Characteristics of study subjects

Overall, the study cohort included 12,961 patients. The surgeon TTL group included 7513 patients (58.0%) while 5448 (42.0%) were initially treated by a non-surgeon TTL for a ratio of 1.38:1. Most surgeon TTLs were from general/trauma surgery (6937/7513; 92.3%) while most non-surgeon

Table 1 Demographic and clinical characteristics of trauma patients by TTL specialty

Characteristics	Surgeon TTL ($n = 7513$)	Non-surgeon TTL ($n = 5448$)	All patients ($n = 12{,}961$)
Age, median [IQR]	45 [28–60]	45 [28–61]	45 [28–61]
Sex, %			
Male	73.6	74.9	74.1
Female	26.4	25.1	25.9
ISS group, %[a]			
9–11	2.3	3.1	2.6
12–15	17.8	16.6	17.3
16–24	40.1	40.5	40.3
25+	39.8	39.8	39.8
Mechanism of trauma injury, %[b]			
Blunt force trauma	90.1	88.3	89.3
Penetrating trauma	9.9	11.7	10.7
Vital signs on arrival, median [IQR]			
Heart rate (beats/min)	90 [77–106]	90 [76–105]	90 [77–106]
Respiratory rate (breaths/min)[c]	18 [16–21]	18 [16–22]	18 [16–21]
Systolic blood pressure (mmHg)	130 [115–147]	130 [115–148]	130 [115–148]
GCS on arrival, median [IQR]	15 [13–15]	15 [13–15]	15 [13–15]
Admission to ICU, %[d]	56.9	54.5	55.9
Went to operating room during admission, %[e]	38.3	40.2	39.0
Went to operating room within 4 h of admission, %[f]	39.4	36.3	38.0
Length of stay, median [IQR]			
Intensive care unit	4 [2–11]	5 [2–11]	–
In-hospital	9 [4–19]	8 [4–18]	–

Data is complete for all variables except for heart rate, respiratory rate, systolic blood pressure, and GCS (see Online Resource 5)

TTL trauma team leader, *SD* standard deviation, *IQR* interquartile range, *ISS* injury severity score, *GCS* Glasgow Coma Scale, *ICU* intensive care unit

[a]The adjusted standardized residuals (ASRs) revealed that patients with ISS scores 9–11 are more representative in the non-surgeon TTL group (ASR = 2.9) and less represented in the surgeon TTL group (ASR = − 2.9), X^2 (3, 12,961) = 10.59, $p = 0.014$

[b]There are significantly more patients with penetrating injuries admitted to the care of non-surgeons; X^2 (1, 12,961) = 10.59, $p = 0.001$. The ASRs revealed that patients with penetrating injuries are overrepresented in the non-surgeon TTL group (ASR = 3.2) and less represented in the surgeon TTL group (ASR = − 3.2). Further, patients with blunt injuries were overrepresented in the surgeon TTL group (ASR = 3.2) and less represented in the non-surgeon TTL group (ASR = − 3.2)

[c]Results from the Mann–Whitney test indicated that the mean ranks of respiratory rate scores for patients managed by non-surgeon TTLs were higher overall (median = 18, IQR = 16–22) compared to patients managed by surgeon TTLs (median = 18, IQR = 16–21) (Mann–Whitney $U = 10{,}199{,}896$; $p = 0.013$; $r = 6.6$)

[d]There are significantly more patients admitted to the ICU for surgeons; X^2 (1, 12,961) = 7.384, $p = 0.007$. The ASRs revealed that patients admitted to ICU are overrepresented in the surgeon TTL group (ASR = 2.7) and less represented in the non-surgeon TTL group (ASR = − 2.7)

[e]Missing 779 cases

[f]Of those who went to the operating room. Missing 166 cases

TTLs were ED physicians (4954/5448; 90.9%). Site-specific TTL specialties are shown in Online Resource 3 and cases led by surgeon or non-surgeon TTLs by site is in Online Resource 4.

Table 1 presents characteristics of the study population. Age and sex were similar between cases led by surgeon versus non-surgeon TTLs. A greater proportion of patients with ISS scores between 9 and 11 were managed by non-surgeon TTLs compared to surgeon TTLs (3.1% vs. 2.3%; $p=0.014$). We also observed a higher proportion of penetrating injuries were admitted to the care of non-surgeon TTLs (11.7% vs. 9.9%; $p=0.001$). There was no difference in-hospital length of stay or ICU length of stay between the two groups.

Main results

There were 1564 deaths in our sample for an overall mortality rate of 12.1% (range 10.1–17.0%). In-hospital mortality was 11.6% of the surgeon TTL group and 12.7% of the non-surgeon TTL group (Table 2). The unadjusted odds of mortality were lower in the surgeon TTL group (OR 0.87, 95% CI 0.78–0.98, $p=0.02$) (Table 2). Risk-adjusted mortality using TRAM methodology showed no difference between patients cared for by surgeon and non-surgeon TTLs (OR 0.92, 95% CI 0.80–1.06, $p=0.23$) (Table 3). The absolute reduction in mortality for patients treated by a surgeon TTL was 1.03% (95% CI 0.11–2.17%). No difference was observed in ED mortality which occurred in 1.0% (71/6930) of patients cared for by surgeon TTLs compared to 1.4% (61/4386) of patients managed by non-surgeon TTLs (1645 patients had missing data).

A total of 8114 (62.6%) patients were nighttime arrivals and 4846 (37.4%) arrived during daytime (Table 4). A larger proportion of non-surgeon TTLs saw patients during nighttime (65.9% vs. 60.2%; $p<0.0001$) (Table 4). Among daytime patients, having a surgeon TTL was associated with decreased unadjusted odds of mortality (OR 0.79, 95% CI 0.66–0.95) and decreased risk-adjusted mortality (OR 0.77, 95% CI 0.61–0.96) compared to having a non-surgeon TTL (Online Resource 5). For nighttime patients, there was no difference in unadjusted mortality (OR 0.92, 95% CI 0.79–1.07) or risk-adjusted mortality (OR 1.01, 95% CI 0.85–1.21) (Online Resource 5). One patient did not have an arrival time documented and was excluded from the daytime/nighttime analysis.

The association between various patient subgroups and mortality is presented in Table 5. Blunt trauma patients had decreased unadjusted odds of mortality when treated by a surgeon TTL (OR 0.86, 95% CI 0.76–0.96) but there was no difference in risk-adjusted mortality (OR 0.90, 95% CI 0.77–1.04). Additionally, there were no differences in risk-adjusted mortality between cases led by surgeon or non-surgeon TTLs for patients who presented

Table 3 Risk-adjusted mortality using multiple logistic regression with the trauma risk adjustment model (TRAM)

Variable	Estimate (95% CI)	*p* value	Odds ratio for mortality (95% CI)
Intercept	− 3.08 (− 3.25 to − 2.92)	< 0.0001	–
TTL surgeon	− 0.09 (− 0.23 to 0.06)	0.23	0.92 (0.80–1.06)
Site 1 (reference)	–		–
Site 2	0.41 (0.22 to 0.60)	< 0.0001	1.53 (1.26–1.84)
Site 3	0.25 (0.04 to 0.45)	0.02	1.29 (1.06–1.57)
Site 4	0.21 (− 0.06 to 0.47)	0.12	1.27 (0.99–1.62)
Site 5	0.26 (0.04 to 0.48)	0.02	1.29 (1.04–1.60)
Site 6	0.11 (− 0.17 to 0.38)	0.45	1.10 (0.84–1.42)
TRAM score	1.01 (0.96 to 1.05)	< 0.0001	2.74 (2.62–2.86)

TTL trauma team leader, *TRAM* trauma risk-adjusted model, *CI* confidence interval

Table 2 Rates of unadjusted in-hospital mortality by TTL specialty and site

Site	Mortality: $n_{mortality}/N_{site}$ (%)			
	Surgeon TTL ($n=7513$)	Non-surgeon TTL ($n=5448$)	All patients ($n=12{,}961$)	Odds ratio for mortality (95% CI)
Site 1	244/2120 (11.5)	77/649 (11.9)	321 (11.6)	0.97 (0.74–1.27)
Site 2	107/1193 (9.0)	155/1400 (11.1)	262 (10.1)	0.79 (0.61–1.03)
Site 3	51/528 (9.7)	92/860 (10.7)	143 (10.3)	0.89 (0.62–1.28)
Site 4	164/954 (17.2)	46/284 (16.2)	210 (17.0)	1.07 (0.75–1.54)
Site 5	26/197 (13.2)	118/708 (16.7)	144 (15.9)	0.76 (0.48–1.20)
Site 6	282/2521 (11.2)	202/1547 (13.1)	484 (11.9)	0.84 (0.69–1.02)
Total	874/7513 (11.6)	690/5448 (12.7)	1564 (12.1)	0.87 (0.78 to 0.98)

Absolute risk reduction in mortality = 1.03% (95% CI − 0.11 to 2.17%)

TTL trauma team leader

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Table 4 Patient arrival time by TTL specialty

Arrival time	TTL specialty		All patients ($n=12{,}961$)
	Surgeon ($n=7513$)	Non-surgeon ($n=5448$)	
Night (5:00 p.m.–6:59 a.m.)	4525 (60.2%)	3589 (65.9%)	8114 (62.6%)
Day (7:00 a.m.–4:59 p.m.)	2988 (39.8%)	1858 (34.1%)	4846 (37.4%)

TTL trauma team leader

Note: non-surgeon group missing 1 value

Table 5 Associations between TTL specialty and mortality in patient subgroups

Subgroup	*n*	Unadjusted odds ratio (95% CI)	TRAM risk-adjusted odds ratio (95% CI)
Blunt mechanism	11,579	0.86 (0.76–0.96)	0.90 (0.77–1.04)
Penetrating mechanism	1382	1.21 (0.85–1.73)	1.15 (0.70–1.90)
Head injury[a]	5119	0.91 (0.79–1.06)	0.95 (0.79–1.14)
Thoracic injury[b]	6270	0.86 (0.73–1.02)	0.88 (0.72–1.08)
Abdominal injury[c]	1723	0.72 (0.52–0.99)	0.87 (0.59–1.28)
Hypotensive[d]	834	0.92 (0.67–1.27)	0.93 (0.63–1.37)
Shock index > 1[e]	1548	0.84 (0.65–1.09)	0.83 (0.61–1.14)
Severely injured[f]	10,375	0.89 (0.80–1.00)	0.91 (0.79–1.05)

TTL trauma team leader, *TRAM* trauma risk-adjusted model, *CI* confidence interval

[a]Defined as Abbreviated Injury Scale Head ≥ 3

[b]Defined as Abbreviated Injury Scale Thorax ≥ 3

[c]Defined as Abbreviated Injury Scale Abdomen ≥ 3

[d]Defined as arrival systolic blood pressure < 90 mmHg

[e]Defined as heart rate/systolic blood pressure

[f]Defined as injury severity score ≥ 16

with traumatic brain injury, thoracic injuries, abdominal injuries, hypotension, or a shock index > 1.

Discussion

Interpretation of findings

In this multicentre study evaluating the effect of TTL specialty on major trauma outcomes, we observed no difference in risk-adjusted in-hospital mortality, but did find that the presence of a surgeon TTL was associated with reduced unadjusted odds of mortality. Surgeon TTLs were less likely to work nighttime shifts; this may account for the difference in unadjusted mortality with no difference in risk-adjusted mortality as previous studies have reported increased trauma patient mortality at night [33–35]. Our study refutes the American College of Surgeons' statement that an "attending emergency physician who is part of the trauma team may be approved to begin resuscitation while awaiting the arrival of the attending surgeon but cannot independently fulfil the responsibilities of, or substitute for, the attending surgeon"[9]. While emergency physicians cannot substitute for surgeons when a patient requires haemorrhage control surgery, the number of patients who require immediate haemorrhage control surgery is small [22, 23, 27–29]. Our large, multicentre study suggests that emergency physicians and other non-surgeons can fulfil the responsibilities of TTL with outcomes comparable to surgeon TTLs.

Comparison to previous studies

Similar to our results, previous studies report no difference in mortality or length of stay between trauma team cases led by surgeon or non-surgeon TTLs [11, 12, 16, 18, 20, 26]. These studies were all performed at single centres with the exception of Cummings et al. which was conducted at two trauma centres [12]. In comparison, our multicentre study involving six sites included nearly 13,000 patients and the ratio of surgeon to non-surgeon TTL cases in our sample (1.38:1) provided sufficient power to detect a 2% difference in mortality. Other studies performed in the Canadian context are conflicting on benefits of multidisciplinary TTLs to patient mortality and delays from the ED but may reduce ICU admissions [21, 36].

Strengths and limitations

The greatest strength of our study is that it is a national multicentre study and is, to our knowledge, the largest study comparing trauma outcomes between cases led by surgeon versus non-surgeon TTLs. Our study also uses risk-adjusted analysis which makes the comparisons more robust. Give that this study question is unlikely to ever be studied using a randomized controlled trial, our study provides the strongest evidence to date regarding the effect of TTL specialty on patient outcomes. While trauma registry data is standardized, collected systematically and audited for accuracy, there are limitations with secondary use of data. Although some patients were missing data, we excluded any cases missing the primary outcome and used multiple imputation for missing variables during risk-adjusted analysis (Online Resource 6). We did not evaluate other outcomes that might have shown differences in management styles (e.g. morbidity, complications, missed injuries). There were smaller numbers of patient subgroups including patients with penetrating trauma, abdominal injuries, hypotension and elevated shock index, thus limiting generalizability to these groups.

Clinical implications

Our study supports a model of care where a surgeon or non-surgeon can lead the trauma teams at level one trauma centres. Given that there was no difference in risk-adjusted mortality in this population, it is unlikely that there would be an advantage of surgeon or non-surgeon TTLs in less severely injured patients with lower predicted mortality. There are opportunities for emergency physician leadership in implementing the mixed TTL model in level 2 and 3 trauma centres as has been done in British Columbia to reduce geographic inequities in trauma care [37]. However, there may be subgroups that benefit from early surgeon involvement in the trauma team. We hypothesize that surgeon TTLs may have a slight advantage in the time it takes to get a severely injured patient with abdominal injuries to the operating room for surgical haemorrhage control. These differences may be highlighted during daytime hours with all in house consultants and immediate access to the operating room as we found there was reduced unadjusted and risk-adjusted mortality for patients treated by surgeon TTLs during daytime hours.

Research implications

The methods of this study did not allow us to determine if surgeon TTLs are able to get patients to the operating room sooner. Further research could examine if surgeon TTLs are able to expedite surgery for haemorrhage control compared to non-surgeon TTLs, and whether this influences patient outcomes.

Conclusion

After adjusting for known predictors of trauma mortality, there was no difference in observed mortality for patients treated by surgeon and non-surgeon TTLs. These findings are relevant to level one trauma centres considering implementing a mixed model of care. Both surgeons and non-surgeons can effectively lead a trauma team with no compromise to the quality of care.

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Author contributions JT conceptualized the study, developed the methodology, assisted in acquiring funding, supervised the project, wrote the initial draft of the manuscript, and oversaw the review and editing of the final draft of the manuscript. RG assisted with methodology and study design, curated the data, undertook the formal analysis, validated all data, and assisted in reviewing and editing the final manuscript. VI assisted with the methodology and study design, data curation, data validation, assisted with project administration and assisted in reviewing and editing the final draft of the manuscript. RG conceptualized the study, developed the methodology, and assisted in reviewing and editing the final manuscript. ME conceptualized the study, developed the methodology, curated data from his site, and assisted in reviewing and editing the final manuscript. JMT conceptualized the study, developed the methodology, and assisted in reviewing and editing the final manuscript. BT assisted with project administration, assisted writing the original draft, and assisted in reviewing and editing the final manuscript. SH assisted with methodology development, undertook the formal analysis, validated all data, and assisted in reviewing and editing the final manuscript. JT assisted with methodology development and assisted in reviewing and editing the final manuscript. PE assisted with methodology development, curated data from his site, and assisted in reviewing and editing the final manuscript. AA assisted with methodology development, curated data from his sitem and assisted in reviewing and editing the final manuscript. AB assisted with methodology development, curated data from his site, and assisted in reviewing and editing the final manuscript. KV assisted with methodology development, curated data from her site, and assisted in reviewing and editing the final manuscript. NP assisted with methodology development, curated data from his site, and assisted in reviewing and editing the final manuscript. CH assisted with methodology development and assisted in reviewing and editing the final manuscript. AC curated data from her site and assisted in reviewing and editing the final manuscript. JL assisted with methodology development, curated data from her site, and assisted in reviewing and editing the final manuscript. IM conceptualized the study, obtained funding, and reviewed and edited the final manuscript.

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Data availability The data that support the findings of this study are available on request from the corresponding author, [JT]. The data are not publicly available as this was not included in the data sharing agreements. Requests for data will need to complete all requirements to ammend the data sharing agreements.

Declarations

Conflict of interest None.

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