Effect of Pursuing Level-II Trauma Certification on Emergency Department Computed Tomography Turnaround Time

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Most trauma patients undergo a significant amount of testing in emergency departments[1] (ED), especially computed tomography (CT). When an ED seeks certification for higher-level trauma care, its doors are opened to an additional patient population with potentially greater resource utilization. It is feasible, in this context, to see a slowed turnaround time (TAT) throughout the ED for tests like CT in response to the new patient population, though relatively few published studies have analyzed this effect.

It has been found generally that CT TAT was quicker for trauma patients in the ED than for ED patients as a whole.[1] This is despite the often more-focused CT studies ordered in atraumatic ED patients.

Our study seeks to elucidate changes in CT TAT due to trauma population by comparing the TAT before and after seeking trauma care certification.

Problem Statement

This quality improvement (QI) study compared CT TAT (minutes) in ED patients at Lehigh Valley Hospital-Muhlenberg after the hospital sought certification for Level-II trauma care, compared to CT TAT before the certification process began.

This study was approved as QI research by the Lehigh Valley Health Network (LVHN) Institutional Review Board (IRB). Study participants included all patient presenting to the ED, and receiving any CT study, in the months of July-October, 2019 (pre-trauma group) or 2020 (post-trauma group). Data was recovered from the hospital electronic medical records (EMR). TAT was defined as the elapsed time (in minutes) between order entry and scan finalization within the EMR.

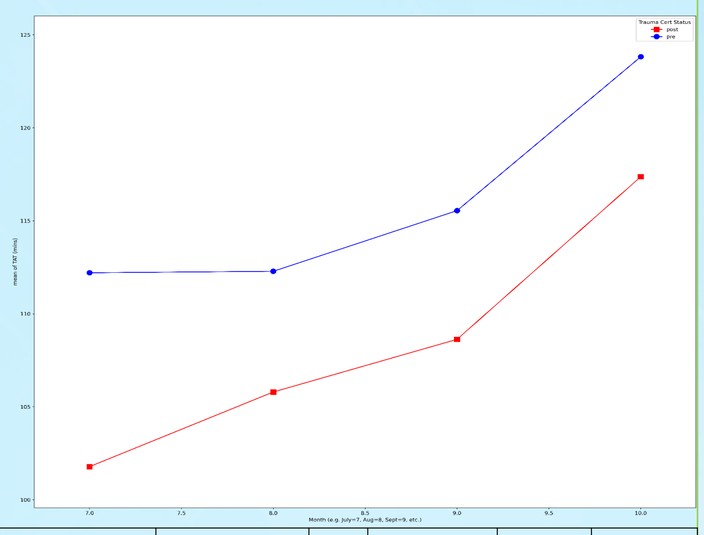
The independent variables were trauma certification status (pre- and post-trauma and month (July-October), while the dependent variable was the CT TAT in minutes. A 2-way factorial analysis of variance-type (ANOVA) was used to test for significance, with Tukey's Honestly Significant Difference (HSD) post-hoc testing. The ANOVA was conducted upon a fixed-effects linear model calculated using ordinary least squares (OLS) methodology. The ANOVA also used type III sum of squares (SS) calculations to accommodate differences in sample sizes, since categorical independent variables in the linear model required dummy variables with a non-orthogonal contrast matrix.

The pre-trauma group (July-Oct. 2019) consisted of 4577 ED patients receiving CT scan, with a mean age of 60.0 years (SD 20.6). The 4156 patients in the post-trauma group (July-Oct 2020) had a mean age of 60.9 years (SD 20.6).

The factorial ANOVA found no significant "Trauma x Month" interactional effect ($F_{3,8725}$=0.4, P=.72). A significant main effect of trauma status ($F_{1,8725}$=27.5, P<.001) indicated that TAT was quicker in the post-trauma group (mean 116.1 min, SD 67.3).

A significant main effect of month was also observed ($F_{3,8725}$=17.8, P<.001). Post-hoc month-vs.-month pairwise testing found no pairwise differences among the months of July, August, or September, but found that TAT was longer in October compared to each of the other three months (see bottom table).

	July	Aug	Sept	Oct	Totals by Status
Pre	112.21 +/- 60.78 n = 1173	112.29 +/- 70.52 n = 1101	115.55 +/- 70.08 n = 1082	123.82 +/- 67.44 n = 1221	116.11 +/- 67.30 n = 4577
Post	101.78 +/- 60.61 n = 1074	105.80 +/- 64.13 n = 1033	108.63 +/- 62.73 n = 978	117.37 +/- 80.84 n = 1071	108.41 +/- 67.85 n = 4156
Monthly Totals	107.22 +/- 60.88 n = 2247	109.14 +/- 67.53 n = 2134	112.26 +/- 66.73 n = 2060	120.81 +/- 74.03 n = 2292	112.45 +/- 67.68 n = 8733



Comparison	Sum Sq	df	Mean Sq	*F*	*P*
Trauma Status	124620.2	1	124620.2	27.45	<.001
Month	242912.6	3	80970.9	17.84	<.001
Trauma x Month	6125.0	3	2041.7	0.45	.717
Residual	39607604.0	3			

Month 1	Month 2	Mean Difference (2−1)	P_{adj}	95% CI, lower	95% CI, upper
July	Aug	1.92	.757	-3.32	7.16
	Sept	5.04	.069	-0.25	10.33
	Oct	13.58	<.001	8.44	18.73
Aug	Sept	3.12	.441	-2.24	8.47
	Oct	11.66	<.001	6.45	16.88
Sept	Oct	8.54	<.001	3.28	13.81

While these results are informative on a gap in current research, the results are limited. The 2019 (pre-trauma) group was collected prior to the substantial incidence of SARS-CoV-2 infection in Lehigh Valley[2], whereas the 2020 (post-trauma) group was entirely collected after. While significant effects of the trauma certification initiative were observed, these effects cannot be statistically differentiated from any effects of COVID-19 on CT TAT. This potentially limits the external validity of these results, and further post-trauma data are required to improve generalizability.

It has been found that ED presentations decreased in early 2020 compared to matched months in 2019[3], even for diagnoses for which a decline in incidence secondary to COVID-19 has not been observed (e.g. myocardial infarction). A smaller post- than pre-trauma sample was also found here. Because a decrease in ED patient volume could feasibly shorten the overall CT TAT in the ED, effects of COVID-19 cannot be ruled out as a confounding factor.

These results inform on a potential gap in the existing body of research, and have implications for how hospitals plan for the changes requisite in seeking higher-level trauma accreditation. The study design itself may also serve as a framework for future QI studies analyzing the effects of large-scale process changes within hospital departments.

In this way, the results for these kinds of studies can be applied prospectively, to plan resource allocation for process changes such as trauma accreditation, and may be applied retrospectively to appraise the effectiveness and efficiency of changes undertaken during and after these processes.

REFERENCES

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