Science

COVID-19 Pandemic Once Again Exposes the Weakest Link in Laboratory Services: Specimen Delivery

Ivana Lapić, MSc, Sven Komljenović, MSc, Josip Knežević, MSc, Dunja Rogić, PhD*

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ABSTRACT

Objective: Reorganization of the emergency department (ED) during the COVID-19 pandemic implied closure of the ED-dedicated laboratory and manual transport of all specimens to the dislocated central laboratory. The impact of such reorganization on laboratory turnaround time (TAT) was examined.

Methods: The TAT from blood sampling to specimen reception (TAT1), from specimen reception to test reporting (TAT2), and from sampling to test reporting (TAT3) were compared between the pandemic peak month in 2020 and the same month in 2019. We evaluated whether TAT2 fulfills the recommended 60-minute criteria.

Results: A statistically significant difference was observed for all comparisons ($P < .001$), with TAT1 prominently contributing to TAT3 prolongation (from 48 minutes to 108 minutes) and exceeding the recommended 60-minute criteria. The TAT2 was extended from 33 minutes to 49 minutes.

Conclusion: An ED reorganization compromised the usual laboratory services for patients in the ED, with manual specimen delivery being the main cause for TAT prolongation.

Keywords: preanalytical phase, emergency department, COVID-19, specimen delivery, turnaround time, emergency laboratory

The COVID-19 pandemic has caused unexpected and drastic challenges within healthcare systems worldwide in terms of providing efficient diagnostic and therapeutic services while maintaining high biosafety standards, thus imposing the need for prompt reorganizational strategies. Emergency departments (EDs), being at the front line of the pandemic, had to introduce profound changes into their working routine, the main being partition of the ED into 2 thoroughly segregated and non-interefering sections: the COVID-19 path designated for patients with suspected COVID-19 and the clean path for all other emergency patients.[1-4]

The University Hospital Center Zagreb ED has applied this rule and underwent required organizational changes at the very beginning of the COVID-19 outbreak in Croatia (mid-March 2020). Laboratory services in our hospital consist of 1 main laboratory unit and 2 satellite urgent laboratories: 1 located in the ED and the other within the Department for Obstetrics and Gynecology. All laboratories release results directly into the hospital information system. The distances from these two emergency laboratories in relation to the main laboratory are approximately 1 and 4 km, respectively. Because the satellite emergency laboratory happened to be located in the newly dedicated COVID-19 wing, it had to be closed immediately. As a consequence, all laboratory tests for patients admitted to the ED had to be processed within the main laboratory unit. In the present study, we examined the impact of such a reorganization on overall laboratory turnaround time (TAT) for ED specimens.

Abbreviations

ED, emergency department; TAT, turnaround time; TAT1, TAT from blood sampling to specimen reception; TAT2, TAT from specimen reception to test reporting; TAT3, TAT from blood sampling to test reporting.

Department of Laboratory Diagnostics, University Hospital Center Zagreb, Zagreb, Croatia

*To whom correspondence should be addressed.
ivana.lapic@hotmail.com

Materials and Methods

The following TATs for the same 1-month period (from mid-March to mid-April) in 2020 and 2019 were extracted from the laboratory information system, BioNET LIS (IN2

Table 1. Comparison of Evaluated TATs between 1-Month Period in 2020 for ED Specimens and Same Period in 2019

	TAT1, min		TAT2, min		TAT3 (overall TAT), min	
	2019	2020	2019	2020	2019	2020
Median (IQR)	10 (5–19)	52 (35–73)	33 (27–44)	49 (38–68)	48 (37–65)	108 (85–137)
P	<.001		<.001		<.001	

TAT, turnaround time; TAT1, TAT from blood sampling to laboratory specimen reception; TAT2, TAT from laboratory specimen reception to test reporting; TAT3, TAT from blood sampling to test reporting; IQR, interquartile range.
P <.05 was considered statistically significant.

Group, Zagreb, Croatia) and compared: TAT from blood sampling to laboratory specimen reception (TAT1), TAT from laboratory specimen reception to test reporting (TAT2), and TAT from blood sampling to test reporting (TAT3 or overall TAT).

In 2020, all ED specimens were transported and processed in the central laboratory, which required approximately 12–13 minutes of walking time and the use of (and waiting for) an elevator; in 2019, the ED-dedicated laboratory, located only meters away from patient examination booths, was operating regularly. The present study included all patients admitted to the internal medicine emergency unit who underwent laboratory testing as part of ED management. Because most patients usually have several groups of laboratory tests requested and respective blood tubes drawn, followed by different specimen preparation requirements and analysis duration, test reporting time inevitably differs. Thus, the test reporting time used in TAT calculation was the time pertaining to the last result(s) reported for the respective patient.

To assess whether the addition of ED specimens to the regular workload of the central laboratory had an effect on its TAT, we compared the TAT2 within the main laboratory unit between the 2 observed periods. Finally, we evaluated whether the TAT3 of ED specimens analyzed in the main laboratory in 2020 (ie, during the pandemic) fulfilled the generally recommended 60-minute criteria for emergency laboratory tests.[5]

Distribution of data normality was assessed with the Shapiro-Wilk test. Given the non-normal distribution, TATs are presented as medians and interquartile ranges and the Mann-Whitney *U* test was used for their comparison; a *P* value of .05 was considered statistically significant. Statistical analysis was performed using MedCalc software, version 19.1.3 (MedCalc, Ostend, Belgium).

Results

In the peak pandemic month studied in 2020, a total of 2751 patients in the internal medicine ED were processed; within the same period in the previous year (2019) there were considerably more patients who presented to the ED and were tested in the laboratory: 3434 patients (a difference of 20%, probably because of patients' reluctance to require medical help during lockdown).

Table 1 summarizes the comparison of evaluated TATs. Statistically significant difference was observed for all comparisons, with TAT1 prominently contributing to TAT3 prolongation. Thus, TAT3 for ED specimens during the COVID-19 pandemic largely exceeded the recommended 60-minute criteria. Higher workloads at the central laboratory because of analysis of additional specimens from the ED did not affect its TAT2, being equal in 2019 and 2020 (63 minutes).

Discussion

The results of our study reveal that the urgent and somehow haphazard reorganization of the ED during the COVID-19 pandemic requiring a temporary shutdown of the ED-dedicated laboratory significantly prolonged overall TAT. As observed, the first underlying reason is undoubtedly the need for longer specimen transport to the relatively distant central laboratory, done exclusively on foot, extending the specimen transportation time from a previous 10 minutes up to a median of 52 minutes.

Simultaneously, as the extraordinary pandemic situation required staff redistribution to newly established duties

such as patient triage and monitoring at several hospital entrances,[6] the ED experienced acute staff shortages. Additional quick and efficient workers urgently needed for laboratory specimen transportation tasks were simply not available. Therefore, for the most part nurses on duty or auxiliary hospital staff delivered specimens to the laboratory along with their regular work obligations. Strategic reduction of hospital personnel caused by staff splitting into teams to maintain a functional workforce may be considered an additional important contributing factor.[7,8]

In addition, the specimens from the ED were processed within the central laboratory together with the usual emergency inpatient specimens, effectively doubling its workload and thus surpassing the current capacity of centrifuges and analyzers. This in turn caused a less prominent but still detectable prolongation of TAT2 for ED specimens. Interestingly, the higher workload at the central laboratory did not prolong its usual TAT2, probably because additional laboratory technicians were recruited from the ED-dedicated laboratory. However, the central laboratory TAT2 is commonly twice as long as the TAT2 usually obtained in the ED-dedicated laboratory (63 minutes compared to 33 minutes). Therefore, such a reorganization in terms of TAT further compromised the usual laboratory services for patients in the ED. The combination of all these aspects ultimately affected the overall TAT3, which largely exceeded our usual recommended and achieved 60 minutes for emergency laboratory tests.

As a consequence, discussions were held with all relevant parties to improve this situation. We are not aware whether this prolongation caused adverse effects or compromised patient safety in any way, which can be considered a limitation of our study that surely deserves further investigation. However, we did receive several complaints from ED physicians regarding prolonged TAT. Therefore, shortly after the first peak pandemic period ebbed in Croatia, which was the period studied herein, a dedicated COVID-19 hospital wing was moved further into a remote part of the ED. Immediately afterward, the temporarily closed satellite ED laboratory resumed its standard operation. Subsequently, there were no further complaints regarding the ED laboratory TAT. In our setting, where a pneumatic tube system for distant specimen transportation is not available, manual delivery of specimens was identified as the single main cause for TAT prolongation. Therefore, the existence of a decentralized ED-dedicated laboratory in our hospital is still indispensable. Although automated delivery systems considerably reduce both TAT and personnel requirements, thus improving the overall workflow, they may also increase the rate of hemolyzed specimens, which can be especially inconvenient in the hemolysis-prone ED setting.[9,10]

Conclusion

Taking into account the sudden COVID-19 outbreak, which created an urgent need to separate patients with suspected COVID-19 from all other patients in the ED, along with existing spatial restrictions within our ED, the hastily undertaken organizational solution was valid and highly justifiable in terms of containing the spread of this looming disease. However, insufficient attention was given to the fact that laboratory diagnostics provided in a distant location require not only longer specimen delivery time and additional dedicated staff, but also higher-capacity analyzers. It was unequivocally shown that any changes in hospital management that affect total testing processes need to be carefully examined beforehand with potential weak spots identified on time and prevented, if possible. Such an approach was understandably hard to achieve in the early days of the pandemic. However, the clear and unambiguous findings of this study should not be forgotten but rather taken into consideration before attempting any future reorganizational strategies within ED laboratory services. **LM**

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