



Do error rates change in the emergency department when patient volume decreases: the effect of COVID-19 on ED error

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Abbreviations

ED Emergency department
PPE Personal protective equipment

Dear Sir,

With the onset of COVID-19, emergency department (ED) patient volumes dropped dramatically, decreasing on average by > 40% across multiple health care systems in the US [1, 2]. Different theories have been suggested for this dramatic decrease in volume, including fear of contraction of the virus, expected excessive wait times, perceived need to conserve space for the critically ill, and concern for medical error given a fear of inability of healthcare workers to function as usual [1]. Health care worker performance may have been compromised due to poor health, staffing shortages secondary to illness, quarantine, or an unwillingness to work at the height of a pandemic [1].

Errors have been recognized as a major source of adverse events in medicine since the 1990s [3, 4]. Several issues have been associated with the quality of emergency care and its timely delivery, including organizational systems, workload, time pressure, teamwork, human factors, and case complexity [5]. Growing literature ascribes ED error to increasing lengths of stay, boarding, and overcrowding [6–8]. Given a significant decrease in ED patient volume with the arrival of COVID-19, and an expected easing of all of these deterrents to quality healthcare, one might expect a commensurate decrease in the numbers of errors. However, the pandemic introduced additional complexity in the quality of health care in this environment, such as distractions to

usual care, uncertainty in outcomes and potential dangers in the workspace itself. These complexities could potentially increase error rates.

The objective of this study was to determine whether a decrease in ED volume, as reflected in the early stages of COVID-19, affects the rate of error in the ED.

Methods

Study design

This was a retrospective study of all patients presenting at the onset of COVID-19 to a tertiary care academic ED (annual census of 57,000) from 4–1–20 to 6–30–20 (quarter 2). We compared quarter 2 data from the previous 2 years, April–June, 2018–2019. Cases were identified by EMR utilizing our previously described system for error identification [9]. Criteria for review included patients (1) returning to the ED < 72 h and admitted on their second visit; (2) admitted from the ED to the floor and transferred to the ICU < 24 h; (3) expired < 24 h; (4) requiring airway management; and (5) patient and physician complaints, including triage, diagnosis, medication, sign-out and communication errors. Cases were randomly assigned for peer review to ED physicians not involved with the care. All cases were reviewed using a validated structured electronic tool that assessed the occurrence of error and adverse events [10].

Selection of participants

All patients presenting to ED within the study period were eligible for inclusion. With the exception of cases identified by patients or complaints, cases were identified by an electronic QA dashboard that interfaced with a commercially available HIS [11]. For cases that originated by patient complaint, ED leadership made subjective decisions about whether to assign for full review or utilize an individual screening review first.

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Data collection and processing

Physician-reviewers not involved in the care of study patients reviewed each case independently. Cases were scored according to an 8-point Likert scale to determine whether: (1) errors were made by the ED; (2) adverse events occurred; (3) documentation was adequate; (4) resource utilization was appropriate; (5) procedures were performed competently; (6) ED medical judgment was adequate; and (7) care coordinated appropriately. A QA committee of physicians, nurses, hospital QA representation and ancillary staff adjudicated each case in a manner consistent with our previous work [10].

Statistical analysis

We reviewed events of interest across 3 time-periods (2018, 2019 and 2020). For each variable, a five-sample test for equality of proportions was used to test the null hypothesis that the observed proportions are equal across the 3-year groups.

Results

ED volume in 2020 when compared to 2019, decreased by 35%, compared to 2018, 38%. There were statistically significant differences in proportions between groups for all variables, including total number of reviews in each time group ($p < 0.01$ in each instance) (see Table 1). For all variables, post-hoc pairwise comparisons were used to identify differences in proportions between pairs of groups, with Bonferroni's correction applied to adjust for multiple comparisons (see Table 2). A significantly larger percentage of cases were reviewed in 2020 when compared to 2019 but significantly less than those reviewed in 2018. For 72-h returns and patients expiring < 24 h, there were no significant differences during the height of COVID-19 in 2020 when compared to 2018 and 2019. There was a statistically

Table 2 *P* values for pairwise comparisons of proportions (adjusted for multiple comparisons)

Variable	2020 vs 2019	2020 vs 2018
Total number of reviews	$p = 0.02$	$p < 0.01$
72-h returns	$p = 1.00$	$p = 1.00$
Death within 24 h	$p = 1.00$	$p = 1.00$
Floor to ICU transfers	$p = 0.03$	$p < 0.01$
All other reviews	$p = 1.00$	$p < 0.01$
# of errors	$p = 1.00$	$p = 0.23$
# Errors compared to all ED patients	$p = 1.00$	$p = 1.00$

significant increase in floor to ICU transfers compared to the 2 prior years and other reviews compared to 2018. For all remaining reviews, there was no statistical difference between 2020 quarter 2 to prior years. Finally, between quarter 2 in 2020 and 2019 and 2018, there was no statistically significant difference in total number of errors.

Despite the reduced volume at the height of the COVID-19 pandemic, when the overall incidence of error among all ED patients during the height of the pandemic was compared by the same quarter in each prior year, there were no significant difference in the rates of error. Table 3 delineates the specific types of error. When error was adjusted for triage related error and the number of errors decreased to 21 for 2020, there was still no statistical difference in the rate of error.

Discussion

Although there was variation from year to year, we did not demonstrate a uniform significant decrease in error despite reduced ED volume during the height of the first wave of the pandemic. Typical types of physician or nursing errors related to medication, diagnosis, sign-out and communication, common during non-pandemic times did not differ in type and quantity compared to our previously described taxonomies of error [9, 10]. See Table 3.

Table 1 Proportions of events of interest by year group

Variable	Quarter 2 2020	Quarter 2 2019	Quarter 2 2018	<i>p</i> value
Total number of reviews/per patient seen in the ED	5% (378/7001)	4% (475/10812)	7% (801/11300)	$p < 0.01$
72-h returns	15% (55/378)	17% (82/475)	12% (96/801)	$p < 0.01$
Death within 24 h	5% (18/378)	7% (32/475)	3% (26/801)	$p < 0.01$
Floor to ICU transfers	16% (62/378)	9% (45/475)	7% (53/801)	$p < 0.01$
All other reviews	64% (243/378)	67% (316/475)	78% (626/801)	$p < 0.01$
# of errors	7% (27/378)	5% (26/475)	4% (31/801)	$p < 0.01$
# of errors compared to all ED patients	0.39% (27/7001)	0.24% (26/10812)	0.29% (31/11300)	0.13% (202/152,214)

Table 3 Error breakdown during COVID 19 peak

Type of error	Number of errors (n = 27)
Order entry	3
Medication error -allergy, dosing, medication interaction	4
Misdiagnosis	1
Triage error	6
Documentation error	3
Sign-out error	3
Discharge error	1
Communication error	2
Testing error	1
Practice guidelines error	3

A logical explanation for the lack of change in error despite reduced ED volumes would be the disproportionately larger number of triage related error. These triage errors were all linked to miss-triage in the setting of COVID-19. All 6 errors, were related to patients placed in areas of the ED where exposure to COVID 19 was high, even though these patients' presenting symptoms were not consistent with COVID-19, and thus considered to be at low risk for the virus based on our knowledge of COVID -19 at the time. The errors were in exposing low risk patients to higher risk patients and potentially contracting the virus while in the ED. Yet, to limit COVID-19 exposure, patient care space in the ED was reduced, as we ceased placing patients in the hallway. Reducing ED care space could have prolonged time in the waiting room awaiting care and increased the error rate due to delays in care. However, we found that door-to-doctor time, ED length-of-stay for admitted patients and door-to-diagnostic evaluation was significantly less, while arrival-to-departure for discharged patients was unchanged compared to pre COVID-19.

COVID-19 clearly decreased ED volume, decreased crowding should decrease error. However, we decreased contact time with patients; to help ameliorate provider exposure to COVID-19 and preserve personal protective equipment (PPE) across our institution, consultants saw most consults virtually rather than in person. In the ED, we limited contact with lower acuity patients to one provider, usually a nurse in (PPE); physicians would see these patients virtually only, utilizing robots and mobile technology. Physical examination was limited as well, i.e., use of a stethoscope during COVID-19 was limited due to concern for equipment and provider contamination and we had a significant reduction in point-of care ultrasound.

We believe a combination of factors, acuity, rampant new use of telemedicine with limited patient contact, minimalist physical examinations with a general fear of contracting the

virus itself (evidenced by shortened ED length of stay and door to diagnostic evaluation in the setting of high patient acuity), as well as anchoring on COVID related diagnoses, all likely contributed to less thorough evaluations allowing for an error rate to be unchanged, despite decreased volumes, when compared to prior years. These factors may be consistent with a recently published paper introducing a taxonomy of error for COVID-19 [12].

Limitations

As a single institution retrospective study, this investigation may have limited generalizability. This study may be further limited by its sample size- underpowered to demonstrate statistical differences between the study populations. Low number of errors suggests that results be interpreted with caution; > 7000 records were screened programmatically and absolute numbers of cases meeting our narrowly defined criteria were small. However, these numbers do not differ significantly from prior studies of error [9]. Expansion of our criteria should result in greater capture of errors in the future.

Conclusions

Medical errors remain a significant concern in EM, even during a pandemic. While the overall incidence of ED error was low, we found that a decrease in volume during COVID-19 did not result in a meaningful change in the rate of error. This is likely multifactorial and may be related to acuity, decreased patient contact time and limited examinations coupled with apprehension related to exposure to the virus.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Human and animal rights statement As this was a health care quality study, it received a research exemption from the institutional IRB.

Informed consent For this type of study formal consent is not required.

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