Implementing Paper Documentation During an Influenza Surge in a Pediatric Emergency Department

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Objective: We hypothesized that a paper documentation and discharge bundle can expedite patient care during an influenza-related surge.

Methods: Retrospective cohort study of low-acuity patients younger than 21 years surging into a pediatric emergency department between January and March 2018 with influenza-like illness. Patient visits documented using a paper bundle were compared with those documented in the electronic medical record on the same date of visit. The primary outcome of interest was time from physician evaluation to discharge for patient visits documented using the paper bundle compared with those documented in the electronic medical record. Secondary outcome was difference in return visits within 72 hours. We identified patient and visit level factors associated with emergency department length of stay.

Results: A total of 1591 patient visits were included, 1187 documented in the electronic health record and 404 documented using the paper bundle. Patient visits documented using the paper bundle had a 21% shortened median time from physician evaluation to discharge (41 minutes; interquartile range, 27–62.8 minutes) as compared with patient visits documented in the electronic health record (52 minutes; interquartile range, 35–61 minutes; $P < 0.001$). There was no difference in return visits (odds ratio, 0.7; 95% confidence interval, 0.2, 2.2).

Conclusions: Implementation of paper charting during an influenza-related surge was associated with shorter physician to discharge times when compared with patient visits documented in the electronic health record. A paper bundle may improve patient throughput and decrease emergency department overcrowding during influenza or coronavirus disease–related surge.

Key Words: surge, influenza, overcrowding

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Emergency department (ED) overcrowding impacts quality of care and patient outcomes.[1–3] Influenza and influenza-like illness (ILI) can exacerbate ED overcrowding significantly impacting ED throughput and lengthening ED stays.[4] Pediatric visits account for most outpatient visits for ILI in the United States,[5–7] and for every 10 children evaluated in the outpatient setting for an ILI, approximately 1 will be evaluated in the ED.[8]

Emergency departments have implemented various influenza-related surge management protocols including patient cohorting and rapid treatment protocols in an effort to minimize the effects of the annual influenza-related surge.[7,9–12] Electronic documentation takes 30% longer than paper charts, and emergency medicine providers spent significantly more time entering data in to electronic health records than on any other activity, including patient care.[13] We hypothesized that implementation of paper documentation during an influenza-related surge in an academic pediatric ED would improve patient throughput.

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METHODS

Study Design and Setting

This was a retrospective observational cohort study using an administrative database to compare flow metrics of patients, with an ILI diagnosis and a low-acuity designation, treated by physicians using a paper bundle for documentation and discharge planning compared with flow metrics of patients documented in the electronic medical record (EMR). The study was performed at an urban, academic, tertiary care pediatric emergency department (PED) and level 1 trauma center with an annual census of over 93,000 patients.

As part of the routine triage process, a pivot nurse is stationed in front of 2 registration desks at the entrance to the PED. The pivot nurse obtains basic triage information on all new patients. Patients are evaluated in assessment rooms behind the pivot nurse and assigned an emergency severity index (ESI) score. Patients with low-acuity illness are assigned an ESI score of 4 or 5.[14] Approximately 55% of PED patients are triaged ESI score 4 or 5 on arrival.[15] Patients with concern for ILI and an ESI level of 4 or 5 are assigned to treatment in a low-acuity or fast track area staffed by general pediatricians, physician assistants, and nurse practitioners. Because of space constraints, low-acuity patients may be seen in up to 3 different physical locations staffed by the same group of providers. Nurses are staffed to providers in a 1:1 ratio.

In January 2018, during a high-volume influenza-related surge, a process was implemented in which the pivot nurse provided a paper bundle to the fast track provider for patients with ILI who met ESI level 4 or 5 criteria. The fast track provider could choose to use the paper bundle rather than the EMR at their discretion. If the provider chose to use the paper bundle, the provider would document "Please see paper chart" in the EMR but would otherwise not use the EMR for documentation. Paper documentation was later scanned into the EMR to allow viewing by other providers. The usual electronic tracking board continued to be used to track patient location and flow, regardless of documentation type.

The paper bundle contained the following:

1. A paper medical record with check boxes for patient demographics, space for a progress note, vital signs, past medical history, diagnosis, medications, immunization history, allergies, laboratory results, radiology results, and billing data;
2. Paper discharge instructions in Spanish and English for viral illness, fever, cold and flu-like illness, cough, myalgia, and pharyngitis;
3. Paper prescriptions for oseltamivir with check boxes for standard dosing;
4. Acetaminophen and ibuprofen dosing charts for provider reference;
5. Precompleted return to school and return to work notes;
6. A list of pharmacies carrying liquid formulations of oseltamivir.

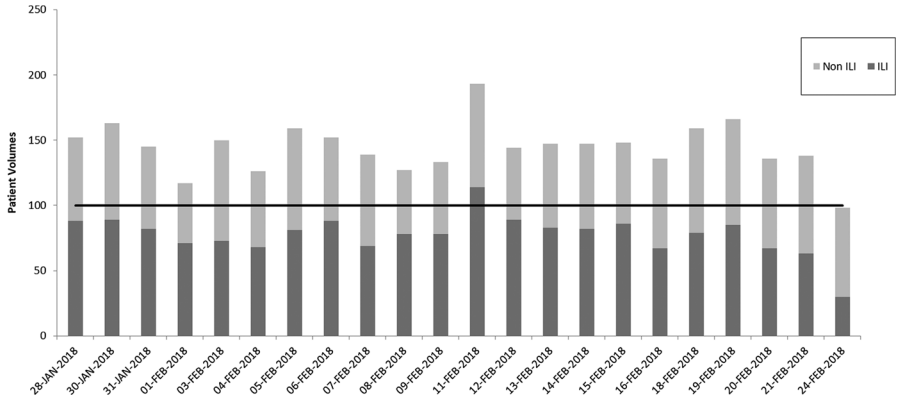

FIGURE 1. Daily influenza and influenza-like illness and total fast track visits during the study period. The solid line indicates baseline volumes.

This project was undertaken as a quality improvement initiative at Children's National Health System and was deemed exempt from review by the Institutional Review Board.

Study Population

Patients were eligible if they were younger than 21 years, presenting to the PED between January 1 and March 30, 2018, triaged as ESI level 4 or 5 and evaluated in fast track with an ILI, identified by provider selected *International Classification of Diseases, Tenth Revision*, diagnosis codes. The Centers for Disease Control and hospital surveillance reports were used to establish the flu season parameters of January 1 to March 30, 2018. Influenza-like illness was defined as a history of fever with cough, pharyngitis, or coryza in addition to systemic symptoms such as headache, myalgia, or fatigue during flu season.

Patients triaged as ESI levels 1 to 3 and those requiring hospital admission were excluded. Patients with chronic disease, immunosuppression, hypoxia, respiratory distress, toxic appearance, or age younger than 4 months would generally be triaged as ESI levels 1 to 3 and therefore not included. Patients seen on days when no paper bundle documentation was used were also excluded.

Outcome Measure

The primary outcome measure was time from provider seen to patient discharge. We anticipated that total ED length of stay would not accurately reflect the use of the paper bundle, as providers were more likely to use the bundle during busier times when time from arrival to provider evaluation would likely be longer. The secondary outcome was ED revisits within 72 hours of index visit. Revisits were defined as unanticipated return ED visit within 72 hours for the same or similar complaint as the index visit. We measured unscheduled returns to the ED within 72 hours as an indicator of potential problems with the medical diagnosis or provider communication with the patient/family using paper charting compared with EMR. We hypothesized that patients with visits documented on paper charts would have shorter provider to discharge times without an increase in revisits within 72 hours.

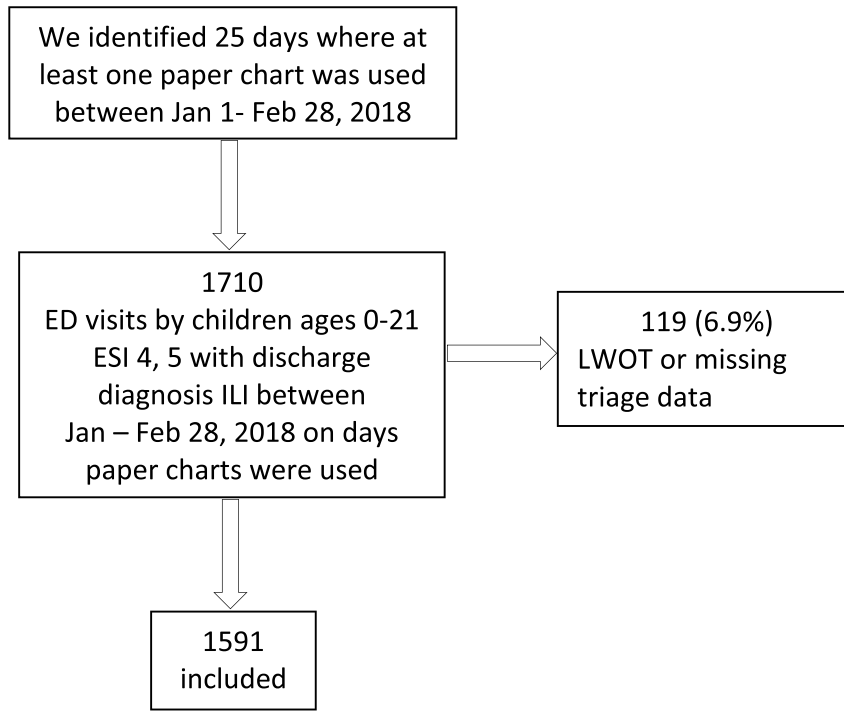

FIGURE 2. Flow diagram of study population.

TABLE 1. Patient and Visit Characteristics

Factor	Characteristic	All	Paper	EMR	OR (Paper; EMR)
Age	Median (IQR), y	5 (2–8)	5 (3–8.75)	4 (2–8)	1.0 (1.0–1.10)
		n (column %)	n (column %)	n (column %)	
	0–2 y	474 (29.8)	96 (23.8)	378 (31.8)	0.6 (0.5–0.9)
	3–5 y	448 (28.2)	122 (30.2)	326 (27.5)	0.9 (0.7–1.3)
	6–7 y	228 (14.3)	61 (15.1)	167 (14.1)	0.9 (0.6–1.3)
	8 or more years	441 (27.7)	125 (30.9)	316 (26.6)	Referent
Race/ethnicity	NH-White	47 (3.0)	7 (1.7)	40 (3.4)	Referent
	NH-Black	849 (53.4)	209 (51.7)	640 (53.9)	1.9 (0.8–4.2)
	Hispanic	695 (43.7)	191 (47.3)	507 (42.7)	2.1 (0.9–4.8)
Triage level	ESI 4	1126 (70.8)	270 (66.8)	856 (72.1)	Referent
	ESI 5	465 (29.2)	134 (33.2)	331 (27.9)	1.3 (1.0–1.6)
Female sex		778 (48.9)	191 (47.3)	587 (49.5)	0.9 (0.7–1.1)
72-h revisit		20 (1.3)	4 (1.0)	16 (1.3)	0.7 (0.2–2.2)
Left without treatment		7 (0.4)	3 (0.7)	4 (0.3)	2.2 (0.5–9.9)
Total		1591	404	1187	

EMR, electronic medical record; IQR, interquartile range; NH, Non-Hispanic; OR, odds ratio.

Data Collection

We extracted all data from the registration ED tracking system (Cerner FirstNet; Cerner Corporation, Kansas City, MO) during dates of service when both the paper bundle and EMR were used. Collected data included patient demographics, diagnosis, and time stamps of various points in the ED visit. Visits with incomplete data due to computer entry error or visits resulting in admission or transfer out of fast track to the main ED were excluded from data analysis.

Statistical Analysis

Statistical analysis was performed using SPSS software version 9.3 (SPSS Statistics for Windows, version 25.0; Armonk, NY). Descriptive statistics were used to describe the study population. We evaluated patient demographic characteristics associated with use of paper charting. χ^2 test and logistic regression were used to determine associations between patient demographics and use of paper charting. The Mann-Whitney *U* test was used to compare differences in median provider evaluation to patient discharge time and total ED length of stay between the group of patient encounters documented on paper and the group documented in the EMR. A sensitivity subgroup analysis was conducted on ESI 4 patients, with anticipated similar resource requirements. We further divided this subgroup into children aged 0 to 2 years versus children 3 years or older given the differences in differential diagnosis of fever in these age groups. All statistical tests were 2-sided, and *P* values of ≤ 0.05 were considered significant.

RESULTS

There were 25 days between January 1 and March 30, 2018, when paper charts were used for low-acuity ILI patients. During the intervention period, the ED experienced an increase in mean daily volume of 51 patients (55%) over baseline volume of 93 (Fig. 1).

We excluded 119 patients because of lack of a provider seen time stamp. There were 1591 patients meeting the inclusion criteria

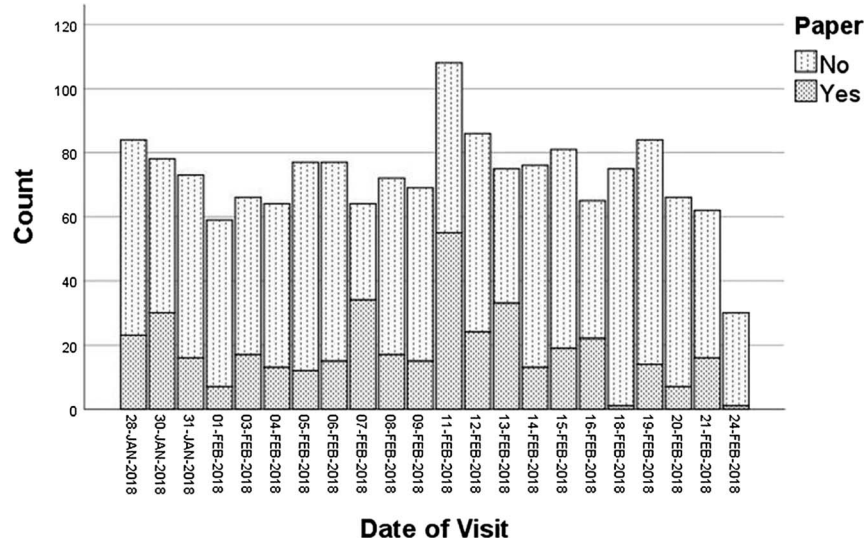

FIGURE 3. Distribution of paper chart use.

on the 25 days when paper charts were used (Fig. 2). The majority of patients (1126, 71%) were triaged as ESI level 4. The median overall age was 5 years (interquartile range [IQR], 2–8 years). The majority were male (51.1%) and of non-Hispanic Black race/ethnicity (53.4%). Patients with visits documented with paper bundles had similar demographics to those documented in the EMR (Table 1). For included encounters overall, the median provider to discharge time was 50 minutes (IQR, 33–76 minutes), and the median length of stay was 182 minutes (IQR, 145–212 minutes).

Providers used the paper bundle for 404 (25.4%) of included patients. On a given day, the percentage of patients for which the providers used the paper bundle ranged from 9% to 50%, with a fairly even distribution of encounters across days with the exception of 2 days when only 1 paper chart was completed (Fig. 3). The 1591 encounters involved 79 different providers, including pediatric emergency medicine physicians, ED-based pediatricians, and physician assistants seeing patients independently. The provider with the most encounters in the sample (114 encounters, 82.4% using the EMR and 17.5% on paper bundle) accounted for 7.2% of the total visits. One provider saw patients on the paper bundle only (n = 4 encounters), 27 providers saw patients using both paper bundle and the EMR (n = 400 paper encounters and n = 556 EMR encounters), and the remainder of providers saw patients using the EMR only (n = 631 encounters). A resident, medical student, or physician assistant was involved in the care of 95 patients (0.06%), and none of these encounters used the paper bundle. For patient encounters using the paper bundle, median provider to discharge time was 41 minutes (IQR, 27–62.75 minutes) compared with 52 minutes (IQR, 35–81 minutes) for patient encounters documented in the EMR ($P < 0.001$). The median length of stay for patients documented with the patient bundle was similar to patients with visits documented in the EMR (180.5 [IQR, 139–210] vs 183 [IQR, 147–213]). There was no statistically significant difference in the 72-hour revisit rate between the 2 groups (odds ratio, 0.7; 95% confidence interval, 0.2–2.2; Table 2).

The statistically significant difference remained in the subgroup analysis of ESI 4 patients in both the older and younger subgroups. For ESI 4 patients aged 0 to 2 years, there was a statistically significant improvement in median provider to disposition times for patient encounters using the paper bundle (37 minutes; IQR, 27–63.75 minutes) compared with patient encounters with visits documented in the EMR (56 minutes; IQR, 38–86.25 minutes; $P < 0.001$). Patient encounter using the paper bundle was 19 minutes or 33% shorter than patient encounters using the EMR. Median provider to disposition times for ESI 4 patients 3 years or older with patient encounters using the paper bundle were 42 minutes (IQR, 27–61.75 minutes) compared with 52 minutes (IQR, 38–82.5 minutes) for encounters using the EMR ($P < 0.001$) (Table 2).

DISCUSSION

As expected, low-acuity patients presenting to the PED with ILI had shorter times from provider evaluation to discharge when the visit was documented in a paper bundle as compared with the EMR. This statistically significant difference was maintained even after subgroup analysis by patient age and ESI level. Patient visits documented using the paper bundle experienced a 21% shortened median time from physician evaluation to discharge (41 minutes; IQR, 27–62.8 minutes) as compared with patient visits documented in the electronic health record (52 minutes; IQR, 35–61 minutes; $P < 0.001$). In an era of social distancing and space limitations, decreasing the time patients spend in rooms adds value to both hospital staff and patient experience.

In this cohort, the overall length of stay for patients with visits documented in the paper bundle was not shorter than those documented in the EMR. Because the choice to use the paper

TABLE 2. Throughput Metrics and Sensitivity (Subgroup) Analysis

	n		All	Paper	EMR	
	Paper	EMR		Median (IQR), min	Median (IQR), min	*P*
Triage to provider	393	1140	113 (82–146.5)	120 (90–148)	111 (79–146)	0.002
LOS	404	1187	182 (145–212)	180.5 (139–210)	183 (147–213)	0.13
Provider to discharge	404	1187	50 (33–76)	41 (27–62.75)	52 (35–61)	<0.001

Age 3 years or older; ESI, 4.

	n		All	Paper	EMR	
	Paper	EMR	Median (IQR), min	Median (IQR), min	Median (IQR), min	*P*
Triage to provider	205	562	113 (81–145)	120 (89.5–148)	108 (79–145)	0.012
LOS	212	586	182 (144.75–213)	180 (135.5–211)	183 (147–213)	0.28
Provider to discharge	212	586	50 (33–78)	42 (27–61.75)	52 (35–82.5)	<0.001

Age 0 to 2 years; ESI, 4.

	n		All	Paper	EMR	
	Paper	EMR	Median (IQR), min	Median (IQR), min	Median (IQR), min	*P*
Triage to provider	56	262	109.5 (80–146.25)	110 (89.5–148)	108 (78–146)	0.35
LOS	58	270	185 (146.25–219)	177.5 (137.25–210.25)	190 (148–220)	0.12
Provider to discharge	58	270	53.5 (36–84.75)	37 (27–63.75)	56 (38–86.25)	<0.001

EMR, electronic medical record; IQR, interquartile range; LOS, length of stay.

bundle was left up to the individual provider, this was expected because we anticipated that providers would be more likely to choose to use the paper bundle during high-volume times, when triage to physician evaluation times tend to be longer. Because of the longer triage time, the overall length of stay for patients documented with the paper bundle was the same as those documented in the EMR. There was no increase in return visits seen for encounters using the paper bundle.

Emergency departments have implemented various strategies to manage annual influenza-related surge.[7,9–12] For example, Cruz et al[7] implemented a mobile pediatric emergency response team in a covered, open-air parking lot to triage low-acuity patients during the spring 2009 novel H1N1-associated surge inpatient volumes and during the same influenza-related surge, Pershad et al[16] described a tent in the ED parking lot for screening patients with ILI. Fagbuyi et al piloted a paper checklist for rapid influenza screening during fall H1N1-associated surge in patient volumes.[12] The paper bundle implemented during this study was comprehensive, including the ability for paper documentation, prescription writing, discharge guidance, and resources for pharmacies. To our knowledge, we are the first to describe, in detail, a comprehensive paper-based bundle designed for use during an influenza-related surge. Consistent with the knowledge that electronic documentation takes 30% longer than paper charts,[13] we found that implementing the option of a paper bundle, in lieu of using the EMR during flu season, shortened the duration of time between provider evaluation and patient disposition.

This study describes a novel tool for implementation during upcoming influenza-related surges. In addition to the benefit of shortened provider documentation time, adoption of a paper bundle allows for freedom to use alternative care sites, which may not be equipped with access to EMRs.[16] We propose that paper bundles be available for optional implementation during high-volume influenza and coronavirus disease–related surges.

Limitations

This study has several limitations. First and foremost, this was a retrospective cohort study based on chart review, and therefore data, were limited and sometimes incomplete. Although we compared patient visits documented on paper with those documented in the EMR on the same days, these 2 groups were seen in different locations by different providers with different nurses, and this could have impacted visit measures in each groups. We do not have access to paper chart completion time because the charts were turned in at the end of the providers shift. We do not have information on which patients got diagnostic tests. The most common diagnostic tests for complaints of influenza in 2018 were Rapid Syncytial Virus/rapid flu and strep tests. It is not clear how these tests would affect doctor to disposition time because those tests were sent by nurses before providers seeing the patient. The patient is not held for those test results but is instead discharged and called by the follow-up team. Emergency severity index level may be an imperfect way to adjust for severity of illness, and it is possible that the encounters documented on paper were less complicated than on those documented in the EMR. However, subgroup analysis by triage level and age showed consistent findings. Another limitation is that this study was performed at a single academic center and a large children's hospital. Consequently, the findings may not be generalizable to all institutions.

CONCLUSIONS

Our findings suggest that implementation of paper bundle during influenza-related surge is an appropriate, safe charting method and can improve provider efficiency. Our model may be useful for future pandemics.

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