The Effects of Computerized Provider Order Entry on Medication Turn-around Time: A Time-to-first Dose Study at the Providence Portland Medical Center

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Certificate of Approval

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"The Effects of Computerized Provider Order Entry on Medication Turn-around Time: A Time-to-first Dose Study at the Providence Portland Medical Center"

Has been approved

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Lastly, I would like to send a special thank you to my loving wife Jennie, for her unwavering support.

Abstract

As the Providence Health System is phasing in its Computerized Provider Order Entry (CPOE) system at the Providence Portland Medical Center, we conducted a study to demonstrate the effects of CPOE on medication turn-around time. Retrospectively, we tracked and compared medication orders that were placed via the existing paper-based system and the CPOE system. The results of this study demonstrate that CPOE positively affects medication turn-around times, and that CPOE is a more efficient process for placing medication orders. Moreover, these results coincide with, and confirm, previous research that has been performed at large academic medical centers.

Introduction

Like many other organizations, the Providence Health System (PHS) has begun its implementation of Computerized Provider Order Entry (CPOE) [1]. The flagship facility for their implementation is the Providence Portland Medical Center (PPMC). As part of its CPOE implementation, the PHS is looking to demonstrate some tangible benefits associated with CPOE. The PHS plans to do this by developing metrics that can be used to compare CPOE to traditional paper-based systems. Therefore we conducted a study to compare the differences of medication turn-around times between CPOE and the paper-based system.

Background

Benefits of CPOE

Since its conception, the benefits of CPOE have been widely documented. These benefits include improved documentation (improved date and time stamp compliance), legibility, medication checks (drug-drug and drug-allergy checks), and turn-around time [2, 3, 4, 5, 6]. Moreover, CPOE, despite some controversy from recent findings, has been shown to reduce medical errors [5, 7]. In addition, CPOE has been shown to positively affect the cost and quality of care [8].

Medication Turn-Around Time

Time-to-first-dose, or medication turn-around time, is considered the interval from the time a medication order was composed to the time the medication is delivered.

Moreover, time to first dose can be broken down into two phases: the time from when the order was composed to the time that pharmacy verifies the order, and the time from pharmacy verification to the time the medication was delivered.

Studies indicate that CPOE can reduce the overall medication turn-around time [2, 3]. Previous work has shown that significant time savings can be achieved in both phases of CPOE [2]. However, the most dramatic time savings are seen in the first phase.

Essentially, CPOE is an intervention that is designed to specifically affect the first phase of time to first dose. CPOE drastically reduces the time it takes an order to be verified by the pharmacy, once it has been written. The reduced time in phase one is attributed to the fact that once an order has been written with CPOE, it is automatically routed to the appropriate department. In this case, the medication orders are routed directly to pharmacy.

Previous work has demonstrated time savings in the second phase as well [2]. However, these savings may vary from institution to institution or even floor to floor.

Previous Work

In general not much has been done to measure the effects of CPOE on medication turn-around times. Largely, these studies have demonstrated reductions in medication turn-around times in academic medical centers rather than community-based hospitals [2, 3]. However, the work that has been done shows promising results.

One study, by Mekhijan et al., at the Ohio State University found a statistically significant 70% reduction in medication turn-around time [2]. The most dramatic time savings were seen in the first phase, which was reduced 33 minutes (0:33) from 3 hours and 57 minutes (3:57). In addition, the time associated with the second phase was reduced to 1 hour and 22 minutes (1:22) from 3 hours and 16 minutes (3:16). Overall, CPOE reduced the medication turn-around time from 5 hours and 28 minutes (5:28) to 1 hour and 51 minutes (1:51).

Another study, conducted by Lehman et al., at Rush, found similar results. This study also found a statistically significant reduction of their medication turn-around time. More specifically, they found that their medication turn-around times were reduced by roughly 64%. Prior to CPOE the average medication turn-around time was 3 hours and 49 minutes (3:49). CPOE, however, reduced this time to 1 hour and 23 minutes (1:23). Overall, the average medication turn-around time was reduced by 2 hours and 26 minutes (2:16) [3].

Setting

The Providence Health System (PHS) is a large integrated delivery network, which operates mainly up and down the West Coast. PHS includes 18 hospitals that are located in Southern California, Oregon, Washington, and Alaska. Three of these hospitals service the Portland area. Together these hospitals account for 5,000+ acute and long-term beds, 36,000 full time employees, and $3.8 billion in revenue. Overall, the PHS serves more that 750,000 people, with roughly 1.5 million annual primary care visits, 2.8 million Outpatient facility visits, and 160 Inpatient admissions.

Providence Portland Medical Center (PPMC)

PPMC is a large metropolitan hospital that is recognized for excellence in patient care and research in cancer, cardiac, orthopedics, women's health, rehabilitation, and behavior health. PPMC contains 483 licensed beds and employs over 3, 300 people, nearly a third of which are medical staff. Annually, PPMC admits over 21,000 patients and receives over 57,000 emergency department visits. PPMC has an average daily patient census of 262 patients, and an average length of stay of 4.5 days[9].

4K

4K is a 21-bed acute rehabilitation unit located on the 4th floor of PPMC. 4K specializes in treatment for patients who have suffered from:

- Catastrophic illness
- Congenital disorders Stroke

- Head and spinal cord injury
- Multiple trauma
- Neurological conditions
- Orthopedic conditions

Generally, patients are referred to 4K by their primary care physician and evaluated by a staff physiatrist. Typically, patients that are admitted to this floor must have functional limitations in two or more of the following areas:

- Cognitive-perceptual functions
- Bowel and/or bladder continence
- Pain management
- Personal care activities
- Mobility

The average length of stay is 9.5 days and the staff comprises several clinical specialties including physiatrists, rehabilitation nurses, physical, occupational and therapeutic recreation therapy, and social work.

Medication Order Processes

Although the end result of carrying out a medication order is the same, the processes that are associated with writing, verifying and confirming a medication order differs between paper and CPOE. To substantiate this point we developed flow charts that illustrate each step of the overall process associated with carrying out a medication

order. Although we feel these are fairly standard processes, across different facilities or institutions, the processes below were derived from workflows observed at PPMC. A flow chart of the medication order processes can be seen in Appendix A.

Paper

For the paper-based system, we begin by writing the order. In order to do this the physician must first locate the chart. Once the chart has been obtained, the physician writes the medication orders and somehow flags the chart. Usually this is done by placing the chart in a certain location, on or near the desk of the health unit coordinator, or making someone (i.e. health unit coordinator or RN) aware there are new orders in the chart. Typically the charts are processed and the orders are "taken off". Under normal circumstances the process of taking the orders off can be thought of as processing a queue, first come first serve. At this point, as the medication orders are being taken off the health unit coordinator notifies the pharmacy that new medication orders exist. This is done by one of three ways, faxing the orders to pharmacy, sending the orders via Pyxis Connect (which is similar to a fax), or telephoning pharmacy to come and retrieve the orders.

The responsibility has now shifted to the pharmacy department, and someone from pharmacy goes to the floor and returns with the new orders. Now the medication orders are queued in the pharmacy department. Again, under normal circumstances these orders are processed as they are received. The pharmacist must then transcribe the order and verify its appropriateness. This step can be quite time consuming and

problematic because many physicians do not have legible handwriting. Once the order(s) has been verified, the medication(s) will be sent to the floor.

At this point, the floor or more specifically the health unit coordinator is made aware of the medication(s) that came from pharmacy. Before the medications are delivered, the nurse must perform a final check. Here the nurse checks the medication from pharmacy against the original order that was written. Providing everything is correct and in order the medication is delivered and charted into the Medication Administration Record.

CPOE

CPOE cuts out many of the time consuming steps in the paper-based system, prior to verification. However, after pharmacy verifies the order the steps are similar, if not identical, to that of the paper-based system.

First, a physician enters the order(s) into a computer workstation. Once the ordering session is complete, the orders are routed and queued in pharmacy. Then the pharmacist verifies the orders and sends the medication(s) to the floor. For CPOE, the act of verifying an order is quite similar to that of paper-based system. However, CPOE eliminates the need to transcribe an often-illegible handwritten order.

Again, after the medication has been verified by pharmacy the processes are similar to that of the paper-based system. The floor is made aware of the medication, the

nurse checks performs the final check (again not needing to transcribe the original handwritten order), delivers the medications, and makes an entry in the Medication Administration Record.

Methods

Using the clinical information systems at PPMC we were able to retrospectively track medication orders that were written on 4K, before and after the CPOE implementation. The orders were tracked by reviewing the paper chart and the order confirmation records. Once the data was collected we then used SPSS to compare the overall mean medication turn-around times between CPOE and the paper-based system. In addition to the overall turn-around time, we compared the times of the two key phases, the time from order composition to pharmacy verification and the time from pharmacy verification to delivery.

Data Collection

In order to review and track the key data points for medication orders on 4K, two "dumps" of the medication orders that were placed on 4K before and after the introduction of CPOE were obtained. This was done by a PHS staff member who queried their clinical information system to obtain a data set of medication orders from 4K that were verified by pharmacy from 8/15/05 – 10/7/05 and from 10/10/05 – 11/02/05.

Essentially, these data sets yielded a "snapshot" of the practice before and after the introduction of CPOE. The data sets consisted of a pharmacy tracking number, the drug name, a patient account number, the date and time the order was verified by pharmacy, the date and time the order was started, and the route, frequency and dose for each medication. A model of the data set is illustrated in Figure 1.

Account Number	Drug Name	Drug Dose	Drug Route	Drug Frequency	Date/Time Composition	Date/Time Verification	Date/Time Delivery

Figure 1. Data model for our data set.

Once the initial data sets were obtained, a protocol was established for including medication orders in this study. Ultimately, the protocol included medication orders that were composed, verified and administered on the same day. Therefore, PRN, or "as needed", medication orders were excluded. However, routine and oral medication orders were included. A detailed description of the protocol can be found in Appendix B.

The study began by tracking the times for the medication orders that were placed via the paper-based system. The patient account number was used to search the PHS medical records for the record of when the medication was ordered. Once the correct record was found the medications from the data set and the medications in the record were matched. The medications were matched using the name, route, frequency, and dose. Once the medication was matched, the appropriate date and time, which indicated when the order was composed, was recorded. The medication order was then classified according to the protocol.

The focus then shifted to the orders that were placed via CPOE. Again, the medication orders that were placed via CPOE were tracked using the same methodology as the paper-based medication orders.

After both data sets were obtained, the elapsed time for each medication order was calculated. This was accomplished by calculating the difference from when the order was composed to when the order was verified by pharmacy. The times were then entered and analyzed with SPSS.

Analysis

Data analysis was performed using SPSS. The times were grouped, according to the data set from which they came, and entered into SPSS. SPSS was used to obtain the descriptive statistics and to perform the appropriate statistical tests. After obtaining the descriptive statistics, a T-test was performed (for unequal variances) on the mean.

The mean, however, is a measure that can be highly influenced by outlying data points. Therefore, other descriptive statistics, such as the trimmed mean and median were also used to compare the differences of medication turn-around times between CPOE and the paper-based system.

Results

We tracked a total of 199 medication orders from 4K. Of the 199 medication orders, 106 (53%) were placed via the paper-based system and 93 (47%) were placed via CPOE.

The 106 medication orders from the paper-based system consisted of 77 valid[1] orders and 29 surrogate[2] orders. Of the 77 valid orders 39 were telephone/voice orders placed by nurses or pharmacy personnel, and 38 were medication orders placed by physicians; see Figure 2.

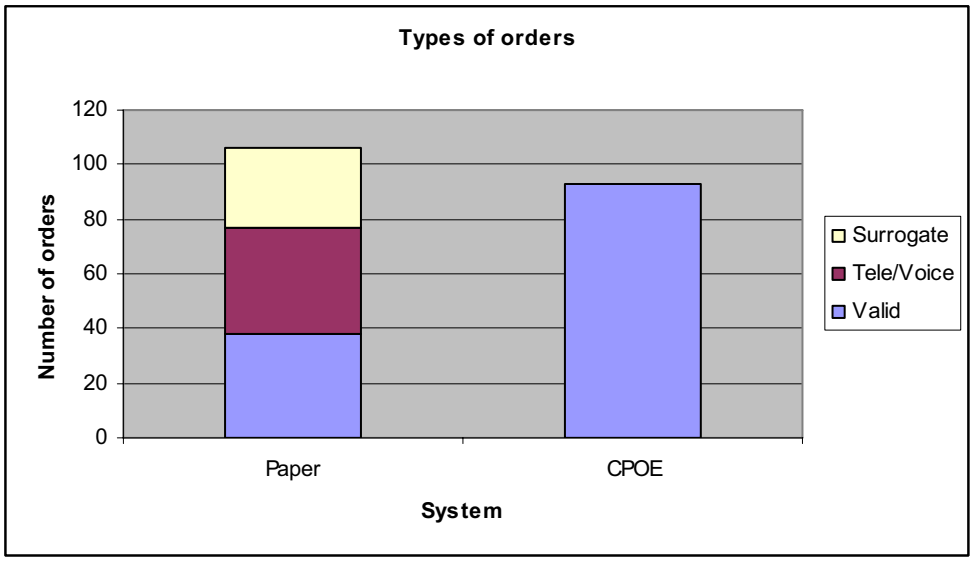

Figure 2. Types of medications orders that were tracked in each system.

Overall, we found statistically significant differences (p=.008) between the means from the paper-based and CPOE systems. The mean medication turn-around time

[1] Valid orders are medication orders that contain a date and time for when they were composed.
[2] Surrogate orders are medication orders that have a date but lack the time. Therefore, the time the order is observed, or "taken off", by the unit coordinator or nurse is used as a surrogate time.

was reduced from 6 hours and 52 minutes (6:52) to 5 hours and 18 minutes (5:18), a reduction of 23%. The paper-based system yielded a trimmed mean time of 6 hours and 25 minutes (6:25), and a median time of 5 hours and 41 minutes (5:41). For the medication orders that were placed via CPOE, all were valid according to our protocol. The CPOE system, on the other hand, yielded a trimmed mean time of 5hours and 16 minutes (5:16), and a median time of 5 hours and 7 minutes (5:07). Full SPSS output can be found in the appendix. These times are illustrated in Figure 3.

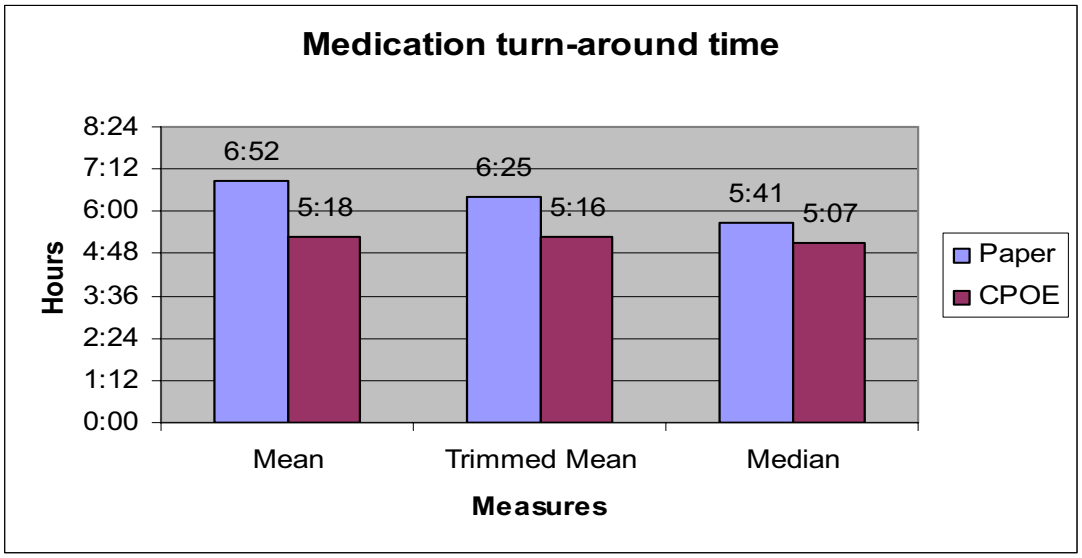

Figure 3. Mean medication turn-around time for the CPOE and paper-based systems.

However, when we looked at each phase separately we found that CPOE only affected the first phase. Therefore, the overall reduction in time was due to a dramatic reduction in time from first phase. Again, we found statistically significant differences ($p<.001$) between the means from the paper-based and CPOE systems.

For this phase, (the time from order composition to pharmacy verification) we found that the paper-based system yielded a mean time of 1 hour and 34 minutes (1:34), a trimmed mean time of 1 hour and 20 minutes (1:20), and a median time of 1 hour and 9 minutes (1:09). The CPOE system yielded a mean time of 37 minutes (0:37), a trimmed mean time of 31 minutes (0:31), and a median time of 20 minutes (0:20), which can be seen in Figure 4. Full SPSS output can be found in Appendix C.

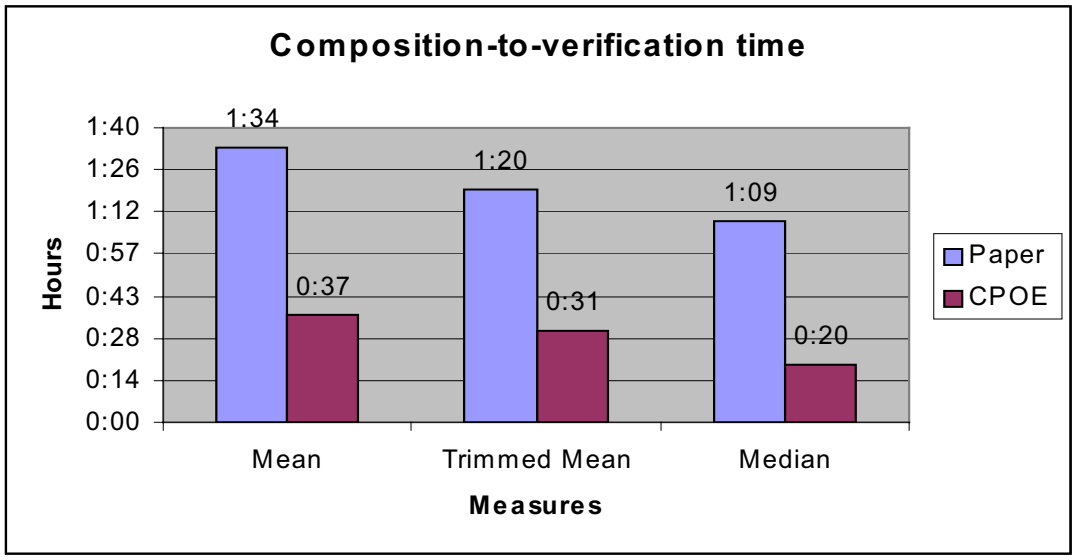

Figure 4. Mean composition-to-verification time for the CPOE and paper-based systems.

Furthermore, when we compared only the handwritten medication orders (that were placed by physicians and had a valid date and time stamp) from the paper-based system to an equal number of medication orders that were placed via the CPOE system, the results were even more dramatic. Overall the mean medication turn-around time, for this comparison was reduced from 7 hours and 14 minutes (7:14) to 4 hours and 50 minutes (4:50), a statistically significant reduction of 33%. Moreover, this comparison showed that CPOE had more of an effect, on the composition-to-

verification time. The mean composition-to-verification time (phase 1) was reduced from 2 hours and 5 minutes (2:05) to 36 minutes (0:36), a statistically significant reduction of 82%. Again, for the second phase (verification-to-delivery), there was not a statistically significant difference between the means of the paper-based system and CPOE. For this comparison, Figure 5 illustrates the differences between the paper-based system and CPOE. Again, full SPSS output can be found in Appendix D.

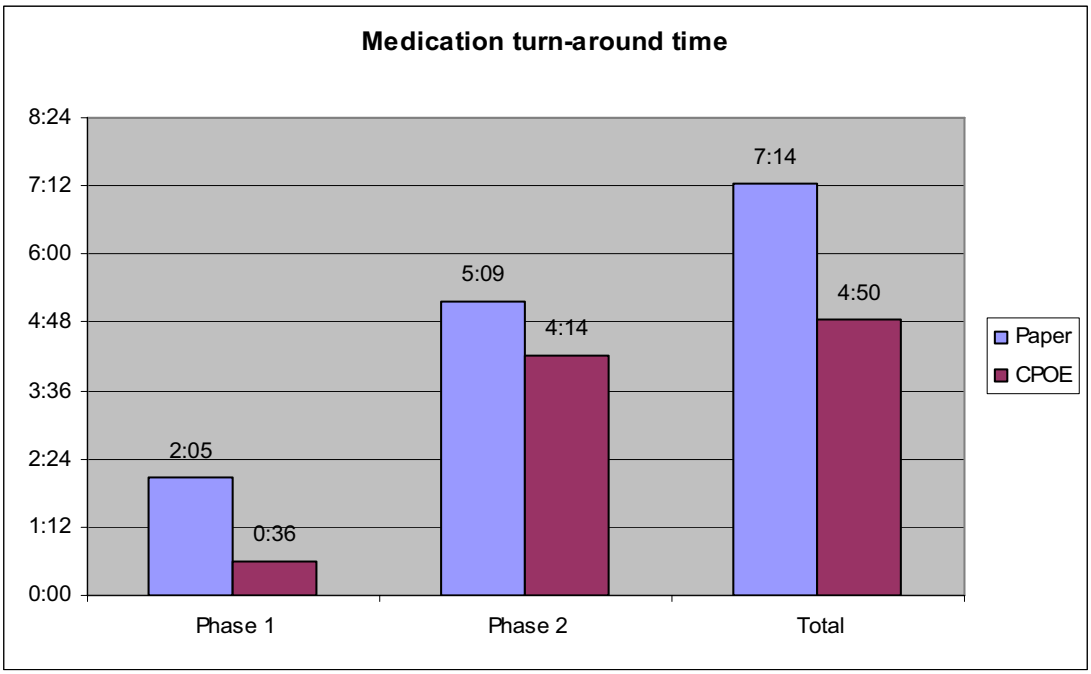

Figure 5. The mean medication turn-around times from the comparison of handwritten medication orders (that were placed by physicians and had a valid date and time stamp) from the paper-based system and medication orders that were placed via the CPOE system.

Discussion

The results of this study are promising. We were able to demonstrate a statistically significant reduction of the overall medication turn-around time. We found substantial time savings in the composition-to-verification phase. This is largely attributed to the fact that CPOE eliminates several time consuming steps during the process of carrying out a medication order.

However, we did not achieve the magnitude of results that were found at Ohio State University by Mekhijan et al. Specifically, our study did not produce the time savings in the latter phase of the medication turn-around time, the time from pharmacy verification to delivery. Nevertheless, our results are positive and show that CPOE allows for more efficient patient care in a clinical setting.

There could be several differences that account for the lack of time savings in the latter half of the medication turn-around time. Two reasons are more apparent and therefore will be discussed. First of all, the nature of the rehab setting may lessen the impact of our results. Most of the previous work has been performed in large academic medical centers, on time sensitive units. Second, the use of "surrogate" times, for the paper-based medication orders, definitely lessens the impact of CPOE.

The setting itself could very well influence the outcome pertaining to the latter half of the medication turn-around time. Being that 4K is a rehab unit, many of the medications that are delivered on this floor are routine and/or oral. The study at Ohio

State University, however, was conducted in a surgical transplant unit. Moreover, the Ohio State study limited its orders to intravenous medications, which in turn excluded routine and oral medications.

Lastly, during the data collection period, we noticed a large percentage of orders that were collected did not have the proper date and time stamp. As previously reported, nearly 30% of the orders did not have a valid date and time stamp; and of the 77 orders that had valid time stamps 50% were telephone/voice orders that were actually placed by nurses or pharmacists. After noticing this trend, and in the interest of time, we decided to include these orders. We felt that the data would have administrative implications and give us insight into the ordering practices of the physicians on 4K. However, we realize that by doing so, we were essentially "washing out", or lessening the impact of the results from our study. Therefore, we have a worst-case scenario of the improvement that CPOE provided when carrying out medication orders. Furthermore, our sub-analysis (of properly timed and dated handwritten medication orders versus the medication orders placed via CPOE) demonstrates that CPOE, as a process, is significantly more effective for placing medication orders than the paper-based system.

Limitations

Despite the promising results of this study, there are limitations of this research. First, the setting in which this study took place, an Acute Rehab Unit, is not the "typical" floor. Therefore, the patient population is quite different from that of a general medical floor. The difference in patient population also implies that the types of medications that are ordered will be different. In this case, time sensitive medications may be ordered less frequently on this floor compared to others.

Another limitation of this study is the fact that 30% of the paper-based orders did not contain the proper date and time stamp. To account for this we used a surrogate time, which consisted of the time that the RN or Health Unit Coordinator "took the order off". We realized that use of the surrogate time makes the paper-based system look better, and in turn lessens the impact of the CPOE system.

Conclusions

The results of this study clearly demonstrate the positive effect of CPOE on medication turn-around time. CPOE was shown to reduce the overall medication turn-around time by 23%. However, the results of this study indicate that CPOE only affected the composition-to-verification portion of the medication turn-around time, and not the latter half, verification-to-delivery.

In addition, the results of this study have both organizational and scientific applications. On an organizational level, these results can be used to build and strengthen internal administrative and/or physician support. In addition, this study demonstrates that CPOE allows for more efficient patient care within the organization. However, in this particular study, CPOE was only shown to affect a certain portion of the medication turn-around time. These findings may be useful to the Providence Health System when making a case for additional interventions like Pyxis machines, which are located on the floors and dispense medications that normally come from the Pharmacy.

Also, from this study, we were able to obtain information about physician ordering practices, such as date and time stamp compliance. Recall that only 70% of the paper-based orders contained the proper date and time stamp; compared to 100% compliance from the CPOE system. Although it was not the focus of the study, this information could be quite useful to administrative personnel within the organization.

Scientifically, the results of this study confirm findings from previous studies at large academic medical centers[2, 3]. Although we did not find nearly the reduction of overall time, we did see an improvement. But more importantly, the results of this study demonstrate that the benefits of CPOE can extend from academic medical centers to community-based medical centers.

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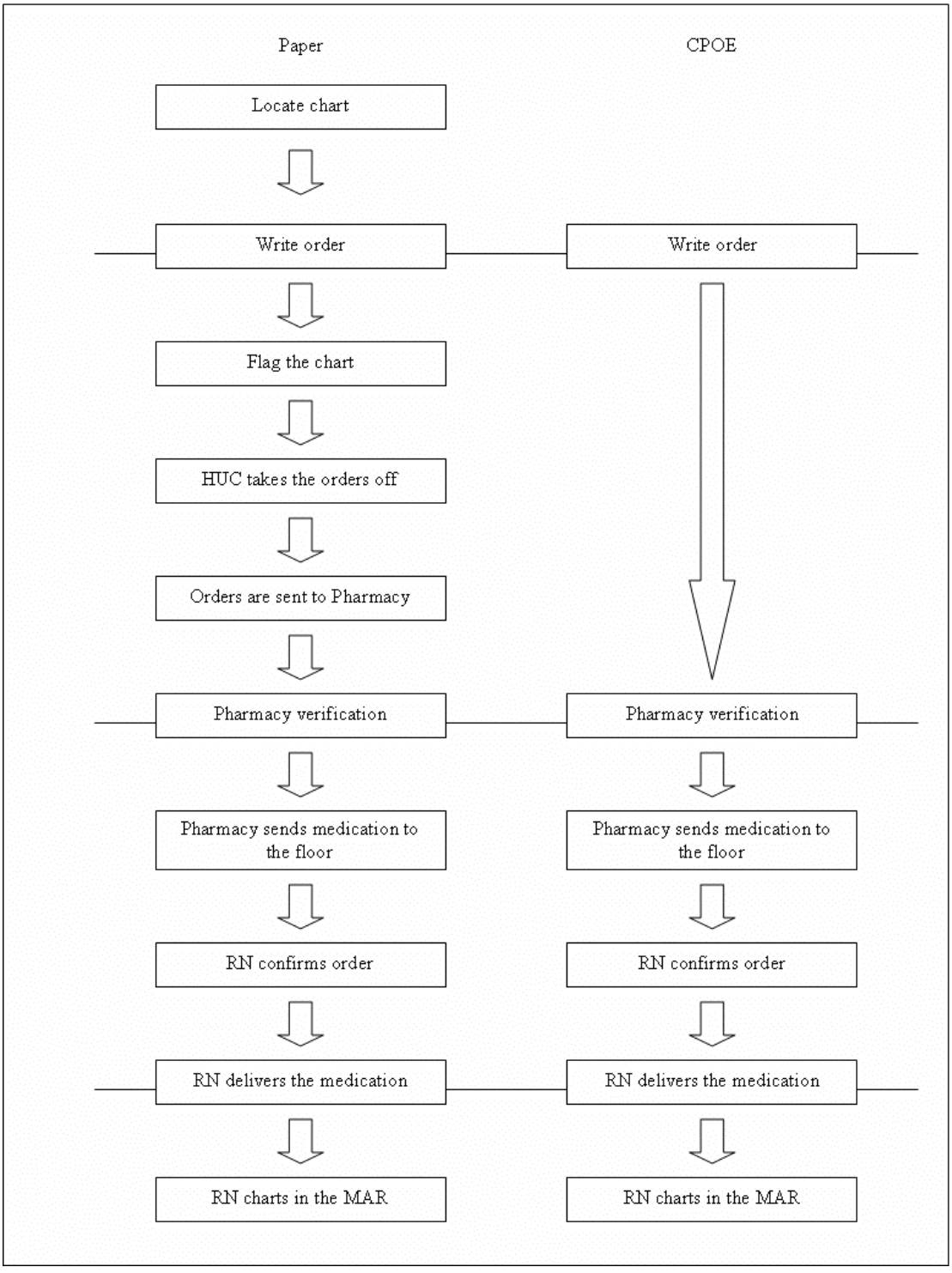
Appendix A


Paper
CPOE
Locate chart
Write order
Write order
Flag the chart
HUC takes the orders off
Orders are sent to Pharmacy
Pharmacy verification
Pharmacy verification
Pharmacy sends medication to the floor
Pharmacy sends medication to the floor
RN confirms order
RN confirms order
RN delivers the medication
RN delivers the medication
RN charts in the MAR
RN charts in the MAR

Appendix B

Inclusion criteria:

1. The order must be a medication order.
2. The medication order must have been placed for a patient of 4K, the Acute Rehabilitation Unit.
3. The medication must be successfully matched by name, route, frequency, and dose between the chart and the query results.
4. A valid medication order must have a date and time, indicating when the order was composed, and the provider's signature
    a. If the provider, composing the order, provided the date but not the time, then the time that the order was "taken off" by the unit coordinator, or nurse, could be used as a surrogate time.
    b. If the provider, composing the order, did not provide the proper date then the medication order must be excluded from the study.
5. Medication orders are then classified as valid and surrogate.
    a. A valid medication order is a medication order that was placed by, or on behalf of a, physician and complies with clause #4. This includes medication orders placed by pharmacy, and nurses, when appropriate.

A surrogate medication order is a medication order that is lacking the time of when the order was composed, as noted by clause #4a.

Appendix C

Descriptives

	Group	Statistic			Std. Error
Phase1	0	Mean		94.11	10.626
		95% Confidence Interval for Mean	Lower Bound	73.04	
			Upper Bound	115.18	
		5% Trimmed Mean		80.27	
		Median		69.00	
		Variance		11968.787	
		Std. Deviation		109.402	
		Minimum		1	
		Maximum		842	
		Range		841	
		Interquartile Range		83	
		Skewness		4.068	.235
		Kurtosis		23.179	.465
	1	Mean		37.29	4.711
		95% Confidence Interval for Mean	Lower Bound	27.93	
			Upper Bound	46.65	
		5% Trimmed Mean		30.51	
		Median		20.00	
		Variance		2063.708	
		Std. Deviation		45.428	
		Minimum		3	
		Maximum		219	
		Range		216	
		Interquartile Range		33	
		Skewness		2.609	.250
		Kurtosis		7.088	.495
Phase2	0	Mean		317.68	26.378
		95% Confidence Interval for Mean	Lower Bound	265.38	
			Upper Bound	369.98	
		5% Trimmed Mean		289.76	
		Median		266.00	
		Variance		73754.734	
		Std. Deviation		271.578	
		Minimum		2	
		Maximum		1304	
		Range		1302	
		Interquartile Range		358	

		Skewness		1.487	.235
		Kurtosis		2.590	.465
	1	Mean		280.90	17.859
		95% Confidence Interval for Mean	Lower Bound	245.43	
			Upper Bound	316.37	
		5% Trimmed Mean		278.20	
		Median		280.00	
		Variance		29661.219	
		Std. Deviation		172.224	
		Minimum		18	
		Maximum		592	
		Range		574	
		Interquartile Range		295	
		Skewness		.164	.250
		Kurtosis		-1.239	.495
Total	0	Mean		411.79	28.698
		95% Confidence Interval for Mean	Lower Bound	354.89	
			Upper Bound	468.70	
		5% Trimmed Mean		384.73	
		Median		340.50	
		Variance		87300.757	
		Std. Deviation		295.467	
		Minimum		26	
		Maximum		1407	
		Range		1381	
		Interquartile Range		350	
		Skewness		1.371	.235
		Kurtosis		2.023	.465
	1	Mean		318.19	17.715
		95% Confidence Interval for Mean	Lower Bound	283.01	
			Upper Bound	353.38	
		5% Trimmed Mean		316.22	
		Median		307.00	
		Variance		29186.462	
		Std. Deviation		170.840	
		Minimum		43	
		Maximum		639	
		Range		596	
		Interquartile Range		288	
		Skewness		.126	.250
		Kurtosis		-1.209	.495

T-Test

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Phase1	0	106	94.11	109.402	10.626
	1	93	37.29	45.428	4.711
Phase2	0	106	317.68	271.578	26.378
	1	93	280.90	172.224	17.859
Total	0	106	411.79	295.467	28.698
	1	93	318.19	170.840	17.715

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Phase1	Equal variances assumed	13.385	.000	4.667	197	.000	56.823	12.175	32.813	80.833
	Equal variances not assumed			4.889	143.979	.000	56.823	11.623	33.848	79.797
Phase2	Equal variances assumed	7.570	.006	1.123	197	.263	36.776	32.759	-27.828	101.380
	Equal variances not assumed			1.154	180.126	.250	36.776	31.855	-26.081	99.633
Total	Equal variances assumed	11.278	.001	2.686	197	.008	93.599	34.849	24.874	162.324
	Equal variances not assumed			2.775	171.797	.006	93.599	33.726	27.029	160.169

Appendix D

Descriptives

	Group	Statistic			Std. Error
Phase1	0	Mean		124.74	12.915
		95% Confidence Interval for Mean	Lower Bound	98.57	
			Upper Bound	150.91	
		5% Trimmed Mean		122.91	
		Median		110.50	
		Variance		6338.253	
		Std. Deviation		79.613	
		Minimum		6	
		Maximum		291	
		Range		285	
		Interquartile Range		152	
		Skewness		.325	.383
		Kurtosis		-.969	.750
	1	Mean		36.24	9.047
		95% Confidence Interval for Mean	Lower Bound	17.91	
			Upper Bound	54.57	
		5% Trimmed Mean		27.93	
		Median		15.00	
		Variance		3110.402	
		Std. Deviation		55.771	
		Minimum		3	
		Maximum		219	
		Range		216	
		Interquartile Range		30	
		Skewness		2.912	.383
		Kurtosis		7.618	.750
Phase2	0	Mean		309.16	42.237
		95% Confidence Interval for Mean	Lower Bound	223.58	
			Upper Bound	394.74	
		5% Trimmed Mean		282.24	
		Median		280.50	
		Variance		67789.920	
		Std. Deviation		260.365	
		Minimum		21	
		Maximum		1304	
		Range		1283	
		Interquartile Range		342	

		Skewness		1.689	.383
		Kurtosis		4.538	.750
	1	Mean		253.97	31.347
		95% Confidence Interval for Mean	Lower Bound	190.46	
			Upper Bound	317.49	
		5% Trimmed Mean		247.73	
		Median		175.50	
		Variance		37339.594	
		Std. Deviation		193.235	
		Minimum		24	
		Maximum		592	
		Range		568	
		Interquartile Range		345	
		Skewness		.540	.383
		Kurtosis		-1.213	.750
Total	0	Mean		433.89	44.153
		95% Confidence Interval for Mean	Lower Bound	344.43	
			Upper Bound	523.36	
		5% Trimmed Mean		413.27	
		Median		417.00	
		Variance		74081.772	
		Std. Deviation		272.180	
		Minimum		30	
		Maximum		1407	
		Range		1377	
		Interquartile Range		403	
		Skewness		1.190	.383
		Kurtosis		3.071	.750
	1	Mean		290.21	30.026
		95% Confidence Interval for Mean	Lower Bound	229.37	
			Upper Bound	351.05	
		5% Trimmed Mean		286.33	
		Median		237.50	
		Variance		34258.387	
		Std. Deviation		185.090	
		Minimum		43	
		Maximum		603	
		Range		560	
		Interquartile Range		322	
		Skewness		.426	.383
		Kurtosis		-1.231	.750

T-Test

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Phase1	0	38	124.74	79.613	12.915
	1	38	36.24	55.771	9.047
Phase2	0	38	309.16	260.365	42.237
	1	38	253.97	193.235	31.347
Total	0	38	433.89	272.180	44.153
	1	38	290.21	185.090	30.026

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Phase1	Equal variances assumed	12.818	.001	5.612	74	.000	88.500	15.769	57.080	119.920
	Equal variances not assumed			5.612	66.266	.000	88.500	15.769	57.019	119.981
Phase2	Equal variances assumed	.525	.471	1.049	74	.298	55.184	52.598	-49.620	159.988
	Equal variances not assumed			1.049	68.272	.298	55.184	52.598	-49.766	160.135
Total	Equal variances assumed	1.983	.163	2.691	74	.009	143.684	53.395	37.292	250.077
	Equal variances not assumed			2.691	65.192	.009	143.684	53.395	37.052	250.316