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Original Research

# Evaluation of STAT medication ordering process in a community hospital

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**ABSTRACT***

**Background**: In most health care facilities, problems related to delays in STAT medication order processing time are of common concern.

**Objective**: The purpose of this study was to evaluate processing time for STAT orders at Kimball Medical Center.

**Methods**: All STAT orders were reviewed to determine processing time; order processing time was also stratified by physician order entry (physician entered (PE) orders vs. non-physician entered (NPE) orders). Collected data included medication ordered, indication, time ordered, time verified by pharmacist, time sent from pharmacy, and time charted as given to the patient.

**Results**: A total of 502 STAT orders were reviewed and 389 orders were included for analysis. Overall, median time was 29 minutes, IQR 16–63; p<0.0001.) . The time needed to process NPE orders was significantly less than that needed for PE orders (median 27 vs. 34 minutes; p=0.026). In terms of NPE orders, the median total time required to process STAT orders for medications available in the Automated Dispensing Devices (ADM) was within 30 minutes, while that required to process orders for medications not available in the ADM was significantly greater than 30 minutes. For PE orders, the median total time required to process orders for medications available in the ADM (i.e., not requiring pharmacy involvement) was significantly greater than 30 minutes. [Median time = 34 minutes (p<0.001)].

**Conclusion**: We conclude that STAT order processing time may be improved by increasing the availability of medications in ADM, and pharmacy involvement in the verification process.

**Keywords:** Drug Prescriptions; Medical Order Entry Systems; Pharmacy Service, Hospital; Clinical Pharmacy Information Systems; United States

## INTRODUCTION

A medication order, which may be provided in verbal, written, or electronic form, is a direction given by a prescriber to dispense and administer medication for a certain medical indication.[1-4] Medication orders may be scheduled, as needed (PRN), or STAT ["stat" is an abbreviation of the Latin word statim, meaning "immediately, without delay"] ; scheduled orders are typically utilized for medications that are designed to give a continuous effect over a certain period of time (e.g., antibiotics)[5], while PRN orders are requested for medications that are to be given in the event of specific signs or symptoms (e.g., analgesics and antipyretics for pain and fever, respectively).[6,7] Many such orders are given as per protocol, or guidelines that dictate when to administer medication, without the need to be ordered with the appearance of signs and symptoms (e.g., insulin sliding scale).[8] Finally, STAT orders, which must be dispensed in a timely fashion, indicate immediate need for the medication.[9]

Of the 3 types of medication orders, STAT orders are most challenging, because these agents must be dispensed in a short time without delay. In addition, STAT ordering is not limited to medications, and practitioners often write STAT orders for other purposes such as laboratory tests or radiological exams.[10-13] The Key steps in STAT ordering process are:

- The medication is ordered by prescriber
- The order is entered into the computer system
- The order is verified by the pharmacy
- The medication is delivered from pharmacy or dispensed from Automated Dispensing Devices (ADM) at nursing stations.
- The medication is administered to the patient

A delay in administration of STAT medications is a common concern. This delay may be a result of one or more of the previous steps involved in the STAT ordering process

Delays in STAT order fulfillment may be prevented/minimized by determining which step(s) is/are the source of delay, and, development and implementation of interventions designed to improve STAT order fulfillment can help to improve this process. A thorough literature review revealed limited studies evaluating the STAT ordering process, but those that were identified showed the positive impact of interventions designed to improve this process. Specifically, a study found that

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implementation of certain criteria such as flagging STAT orders and development of guidelines to be followed for ordering STAT medications improved the process of STAT ordering.[14] Another study found that establishment of a dedicated phone line for STAT orders between pharmacy and nursing stations facilitated communication and solved many STAT orders problems.[15]

The purpose of our study was to evaluate STAT order processing time at Kimball Medical Center, and to identify source(s) of delay, in order to develop strategies to correct procedural defects. In addition, this study was conducted to determine the medications most frequently ordered as STAT.

## METHODS

This was an observational study conducted at Kimball Medical Center (KMC), a 350-bed, fully accredited, acute care hospital in NJ. STAT orders were reviewed over 3 weeks for fulfillment time; inclusion criteria included any STAT order from any unit at KMC and from any prescriber for any indication.

There are two types of STAT orders utilized at KMC, namely Non-physician entered orders (NPE) and physician entered orders (PE). NPE orders are written by the prescriber or ordered verbally, and then transcribed onto a physician order sheet, scanned to the pharmacy, and entered into the computer system by ward nurse or medical transcriptionist. These orders are then verified by a pharmacist and dispensed from ADM or delivered from the pharmacy to the nursing station. PE orders, on the other hand, are entered into the computer system directly by the prescriber. These orders need not be transcribed, scanned to the pharmacy, or verified by the pharmacist (Figure 1).

NPE labels show order entry time and verification time, while PE labels show entry time only. These times, along with delivery time of any medication not available in ADM were recorded and used to determine the total time for order fulfillment, as well as the length of time required for each step in the process. In order to ensure blindness, STAT order labels were collected and reviewed by pharmacy staff not participating in the study.

To evaluate the STAT order timing process, an

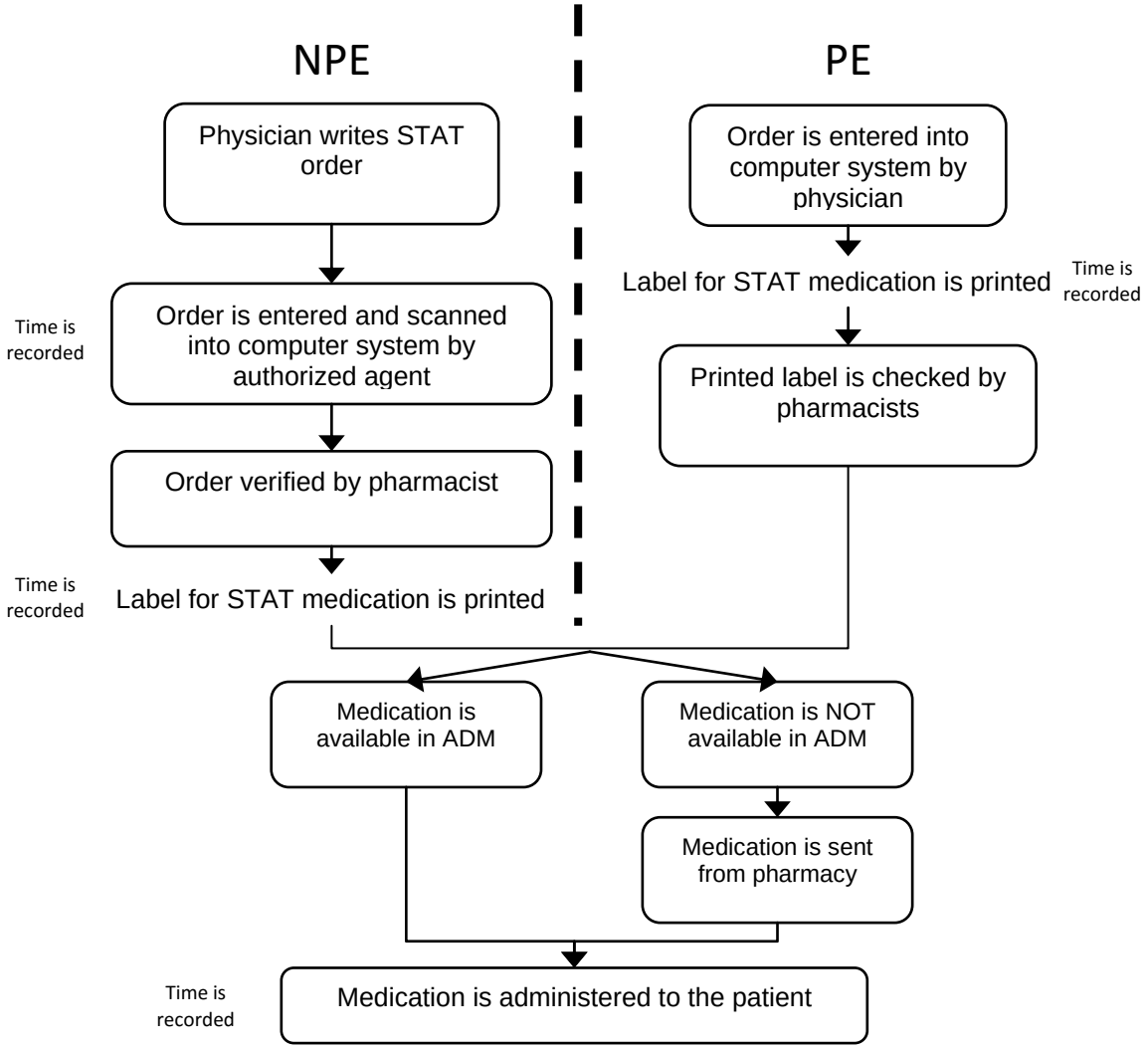


Figure 1. Types of STAT order processing.
Non-physician entered orders (NPE); Physician entered orders (NPE);

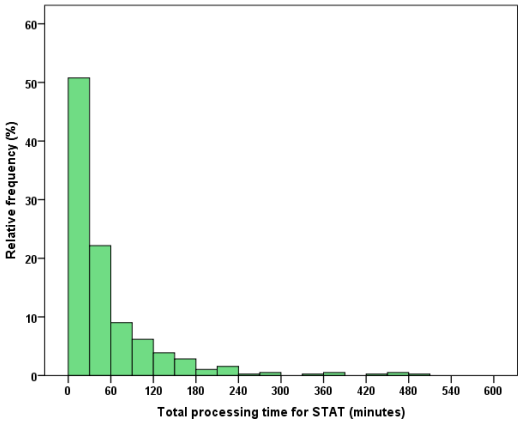


Figure 2. Distribution of processing time of STAT orders

EXCEL software file was used to record the following:

- Entry time into computer system by prescriber or authorized agent
- Verification time by pharmacist for the NPE type.
- Dispensing time for medication not available in ADM
- Administration time
- Total processing time for each STAT order.

The recorded data was then analyzed to determine average total processing time, and to compare it with policy time; according to KMC policy, STAT orders must be administered within 30 minutes of entry. In case of any delays for STAT order processing, data analysis was conducted to determine the source of delay, and its effect on total processing time.

The primary endpoints of the study were average and median total processing time of STAT orders, while secondary end points included most frequently ordered STAT medication and longest component of ordering process.

### Statistical analysis

To determine the processing time, statistical analysis for the data was performed using SPSS 20.0 (SPSS, Chicago, IL, USA) measuring different parameters such as mean (SD), median, and interquartile range (IQR) to increase the reliability of the results. To compare the processing time with the standard time and to show if there is a significant difference between the two types and the different steps within each type, we used Mann-Whitney test because it is much more sensitive than median or t-test, especially in the presence of outliers and when the data is neither symmetrically nor normally distributed.

Table 1. Statistical analysis of STAT types

| | Total | NPE | Pe |
|---|---|---|---|
| Median time (minutes) | 29 | 27 | 34 |
| IQR (minutes) | 16-63 | 16-49 | 15-90 |
| p-value* | <0.0001 | 0.1999 | <0.0001 |

Test value = 30 minutes. IQR= Interquartile range
NPE=Non-physician entered orders; PE=Physician entered orders

## RESULTS

A total of 502 STAT orders were reviewed and included for analysis. Of these orders, 388 (77.6%) were recorded as administered .Of these, 210 (54.1%) orders were NPE, while 178 (45.8%) were PE (p = 0.1043).

Total Time: Fifty one percent of all STAT orders were processed within 30 minutes; approximately 23% were processed in 30 – 60 minutes, while 26% took longer than one hour (Figure 2). Overall, the median time consumed to process all STAT orders was significantly less than 30 minutes (median 29 minutes, IQR 16–63; p<0.0001) (Table 1)

NPE vs. PE: The time needed to process NPE orders was significantly less than that needed for PE orders (median 27 vs. 34 minutes respectively; p=0.026).

NPE Orders: Median total time required to process STAT orders for medications available in the ADM was within 30 minutes [Median time =25 minutes (p=0.983], (Table 2); the time spent prior to verification (pharmacy component) was significantly less than the time spent following verification (nursing component) (p<0.001). For medications not available in the ADM, median total processing time was significantly greater than 30 minutes [Median time=37 minutes (p=0.01] (Table 2), and there was no significant difference between the time consumed before and after delivery from the pharmacy (p=0.186).

PE Orders: Median total time required to process STAT orders for medications available in the ADM was significantly greater than 30 minutes. [Median time=34 minutes (p<0.001)], while that required for medications not available in the ADM (i.e., requiring pharmacy involvement) was not significantly more than 30 minutes. [33 minutes (p=0.073)], and there was no significant difference between the time consumed before and after delivery from the pharmacy (p=0.135).

Additionally, the study found that common pharmacologic classes for medications ordered include cardiovascular agents, antimicrobials, antipsychotics, sedatives and analgesics, bronchodilators, corticosteroids, and laxatives. A list of the medications most commonly ordered as STAT can be found in Table 3.

Table 2. Statistical analysis based on availability in ADM

| | NPE | p-value* | PE | p-value* |
|---|---|---|---|---|
| Medication available in ADM [median (minutes)] | 25 | 0.983 | 34 | 0.010 |
| Medication NOT available in ADM [median (minutes)] | 37 | <0.0001 | 33 | 0.073 |

*p-value at 30 minutes
NPE=Non-physician entered orders; PE=Physician entered orders

| Table 3. Medications most commonly ordered as STAT | |
|---|---|
| 1. Potassium Chloride | 6. Lorazepam |
| 2. Heparin | 7. Phytonadion |
| 3. Furosemide | 8. Ipratropium bromide and albuterol sulfate |
| 4. Aspirin | 9. Vancomycin |
| 5. Hydromophone | 10. Methylprednisolone |

## DISCUSSION

Evaluation of STAT processing is considered an essential process to improve the quality of medication administration.

Results of this study showed that approximately 20% of STAT orders were not documented as administered to patients. Further investigation is needed to determine the reason for lack of documentation of administration, to avoid any resultant clinical and/or financial issues.

Our study showed that the turnaround time of only 50% of STAT orders was within 30 minutes. This low percentage was explained through analysis of steps involved in both PE and NPE ordering types to help us figuring out which steps associated with the delay in processing STAT orders.

This study identifies that the availability of medications in ADM is a main factor in reducing the processing time, as can be seen in NPE in which the processing time was less significantly than 30 minutes with the availability of medications in the ADM. Most health care facilities stock STAT medications in ADMs, thereby facilitating rapid dispensing and administration to the patient.[16-18] Studies showed that availability of medication in ADM helps in reducing the round time cycle of STAT order processing as well as reducing error incidence.[19-20]

Furthermore, the involvement of pharmacy is an important factor in decreasing the processing time. This fact can be seen in NPE in which the pharmacy verification step was involved and lead to decrease in the processing time to less than 30 min significantly even though more steps are involved in NPE orders. Possible reasons associated with this better outcome in NPE include nursing involvement in order entry. This may inform nurses early about the STAT order so they will be following the order. It is also noticed that pharmacy involvement in PE decreased the processing time significantly with non-availability of medication in ADM. This positive impact of pharmacy involvement may be explained by the fact that drug delivery through pneumatic tubes and clarification phone calls may alert nurses that medications are due for administration.

Management of hypokalemia was the most frequent reason for STAT orders.[21] Gennari found that up to 20% of hospitalized patients and up to 40% of patients on diuretics have hypokalemia.[21] Data indicates that 50% of patients who develop hypokalemia during hospitalization had normal potassium level at admission.[22,23] Early management of hypokalemia is very important to avoid cardiovascular adverse events such as cardiac arrest and death.[24,25]

The second most frequent medication ordered as STAT in this study was heparin. Studies have shown that early anticoagulation is associated with low mortality, mainly in acute thrombosis such as pulmonary embolism.[26]

Antimicrobials were frequently ordered as a STAT. The STAT administration of antibiotics is really required in some cases such as sepsis. Delayed administration of antibiotics for septic patients is associated with poor survival outcomes and increased length of stay, especially in area of higher urgency such as Intensive care units.[27-29]

Nevertheless, the present study was conducted at a single hospital, and therefore the findings may not be generalizable to other hospitals. Another limitation of this study was the short period of this study. Despite these limitations, we have now an idea about some reasons associated with delay in STAT ordering process. In addition this study may give a model of analysis to be used for other hospital considering studying STAT ordering process.

## CONCLUSIONS

We conclude that STAT order processing time may be improved by increasing the availability of medications in ADM, and maximizing pharmacy involvement in the order verification process.

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## CONFLICT OF INTEREST

There are no conflicts of interest to declare.

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