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Implementation of disease-based standard order sets in emergency department of tertiary care hospital, Pakistan- a novel approach for enhancing patient care

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Abstract

Objectives: To evaluate the efficacy of disease-based standard order sets in reducing time of order entry, order processing and medication dispensation in emergency department of a tertiary care hospital.

Methods: The pilot study was conducted as part of a retrospective clinical audit using pre- and post-intervention design comprising data from July to September 2013 of the emergency department of a tertiary care hospital in Karachi. Data collected related to the reduction in medicine order entry, processing and dispensing time of eight common emergency conditions with standard order set. Subsequently, standard medication orders for the selected medical conditions were developed together with physicians of emergency and other specialties. Post-intervention data was collected and the two data sets were compared using SPSS version 23.0.

Results: Mean medication order entry and processing time from the physician end improved from 67.7±22.7 seconds to 20.5±7.1 seconds. Mean order processing and medication processing and dispensing time at pharmacist end reduced from 70.0±22.4 to 20.6±8.8 seconds. The difference between pre- and post-intervention values was significant ($p<0.001$).

Conclusion: Implementation of disease-based standard order set significantly improved efficiency.

Key Words: Standard, Order sets, Emergency department, Disease, Time management.

Introduction

The emergency department (ED) is often considered the first point of contact for many patients[1]. It is a gateway to the our health system due to lack of primary healthcare. It is one of the most sensitive and critical areas of the healthcare system and provides essential care to the ill and injured patients[1-2].

In modern healthcare systems, there are numerous challenges within the ED, such as over-crowding, long waiting hours, diminished resources and increased demand[3]. Moreover, patient's expectation for quick and accurate assessment in ED, cost-effective care and timely disposition are on the rise.[4] Both overcrowding and over-expectation leads to delays and dissatisfaction for both patients and physicians, and increases chances of error[5-6].

Implementation of an effective emergency care system could benefit in reducing the disability and mortality rate by one-third to half in low and middle income countries (LMICs), according to the estimates of the Disease Control Priorities Project (DCPP)[1]. One of the best strategies to improve therapeutic outcome among critically ill patients is to reduce the time between the onset of symptoms and the initiation of therapy[3]. Therefore, provision of timely and effective care can reduce complications and hospitalisation among the critically ill patients visiting ED[7-8].

It has been observed that devising medication standardisation prescribing and dispensing system could help both physicians and pharmacists to save time and effort in ED with increased patient influx. Medicine order sets are the essential tools that can save time, improve working efficiency, reduce hospitalisation and help to overcome potential errors[9]. The current study was planned to assess the impact of disease-based standard order sets in reducing the time of physicians and the pharmacist in prescribing, processing and dispensing medication order.

Materials and Methods

The pilot study was conducted as part of a retrospective clinical audit using pre- and post-intervention design comprising data from July to September 2013 of the ED of Aga Khan University Hospital, Karachi, which has an estimated annual ED turnover of more than 65,000 patients. After approval from the Department Heads of Pharmacy, ED, Patient and Therapeutic Committee(P&TC) and the institutional ethics review committee, processes evaluated were medicine order entry, processing and dispensing time of eight common emergency conditions that were selected jointly by the P&TC and the departments of Pharmacy, Emergency and Information Technology (IT) by consensus based on the frequency of presentation of these conditions in ED.

Standardised pre-filled medication orders were studied for the eight conditions: road traffic accidents (RTAs), chronic liver disease, hyperkalemia, chronic obstructive pulmonary disease (COPD), aspiration prophylaxis, allergic reaction, bleeding prophylaxis, and asthma. The standardized medication order entry, processing and dispensing time for adult patients were observed. Neonate and paediatrics populations were excluded because of wide variation in paediatric dosing with respect to weight, age and other vital conditions.

Pre-intervention data related to mean medication order entry, processing and dispensing time from 30 medication orders for each of the 8 conditions from both physicians and pharmacists. The intervention comprised the Plan-Do-

Study-Act (PDSA) model of project management (Table 2). Post-intervention data was also collected on the same parameters from 30 orders for each of the 8 conditions.

The data was collected from the Computerised Physician Order Entry (COPE) log. It is a medication entry system based on desktop computers. In CPOE order entry, physicians enter all the medications according to patient conditions, and, within a second, the physician order appears onto the pharmacy order processing screen. The pharmacists at first have to open the medication order entered by the physicians and then review and process the medication order. All information regarding the entry and processing get stored automatically into the institutional medication order and processing system. However, for medication order filling and dispensing time, manual sheets were used. Every prescription label generated from CPOE system indicates order processing time at the bottom.

The physicians also had the option of editing the order as per patients' need, condition and allergic history.

The data was entered first into Excel and then transferred to SPSS version 23.0. All variables were analysed inferentially by using paired sample t-test.

Results

There were 240 forms each for pre- and post-intervention phases; 30(12.5%) for each of the 8 conditions studied. Mean medication order entry and processing time from the physician end improved from 67.7±22.7 seconds to 20.5±7.1 seconds ($p<0.05$) (Table 3). Mean order processing and medication processing and dispensing time at pharmacist end reduced from 70.0±22.4 to 20.6±8.8 seconds ($p<0.05$) (Table 4).

Discussion

The study highlighted that disease-based standard order set significantly reduced the time both for physicians and pharmacists from order entry to dispensing. This intervention will potentially have an impact on ED patients as it would improve efficiency by enhancing workflow with pertinent instructions that are easily understood, intuitively organised and suitable for direct application in a busy environment. The standard order sets also have the potential to reduce variation in order entry, medication errors and unintentional oversight through standardised formatting and clear presentation of orders. Indirectly, it can also reduce unnecessary calls to prescribers for clarifications and questions about orders[10-13]

The current study showed significant reduction in the order entry and order processing timing post-intervention, which has earlier been reported as well.[14,15]

The prime purpose of the current study was to enhance the service efficiency of physicians and pharmacists working in ED. The World Health Assembly (WHA) has also adopted a resolution on emergency care in order to strengthen the trauma and emergency care services.[16-17]

In this study, it was not possible to randomise the physicians and pharmacists, and, as such, a quasi-experimental design was used which usually measures the effect of intervention without randomisation[18]

The study has its limitations as it was done at a single centre and the results cannot be applied to other hospitals blindly. Similar multi-centre studies are recommended.

Conclusion

Standard order sets represent an excellent way to ensure time-efficient medication administration to all emergency patients. Implementation of disease-based standard order set is a smart approach that reduces the order entry time

from physician's end, and reduces the order processing and dispensing time at pharmacist's end.

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Table 1: Standard Orders for Selected Medical Conditions:

S#	Standard order sets (Direct mnemonic)	Doses Ranges Define in System (min-max)
1	**Aspiration Prophylaxis** 1. Inj.Ranitidine 50mg 2. Inj.Metoclopromide 10mg 3. Oral Sodium Citrate	Inj.Ranitidine (50mg) Inj.Metoclopromide10-20mg Oral Sodium Citrate 30ml

2	**Road Traffic Accident** 1. Ringer's Lactate (2 bags of 1000 ml) 2. Inj.Augmentin 1.2g 3. Inj. Tetanus toxoid (T.T) 0.5mg 4. Inj. Tetanus immunoglobulin (T.I.G) 250 IU 5. Inj. Ketorolac 30 mg	Ringer's Lactate :2000-4000 ml Inj. Augmentin: 1.2 g. T.T: 0.5ml T.I.G : 250-500 IU Inj. Ketorolac : 30-60 mg
3	**Hyperkalemia** 1. Humulin-R 10 Units 2. Dextrose 25% (4 Vials of 25 ml each) 3. Keyaxelate 30g PO & 60g Per rectum 4. Inj.Calcium Gluconate 1 Amp	Humulin-R:10 Units Dextrose: 100ml Polystyrene Sodium • PO :30-60 g • Rect:30-60g Ca-Gluconate:1000-2000 mg
4	**Hepatic encephalopathy** 1. Inj.Ceftriaxone 2g 2. Tab Metronidazole 200mg 3. Lactulose Per Oral (PO) 4. Lactulose Per rectum	Inj.Ceftriaxone: 2g Tab. Metronidazole 200mg Lactulose o PO :30-60ml o Rectally :120-150 ml
5	**Upper GI bleeding** 1. Inj.Omeprazole 80mg bolus 2. Inj.Omeprazole (IV infusion of 8mg/hr.) 3. Piggy N/S 50ml	**I**nj Omeprazole : 80 mg bolus Inj Omeprazole :8 mg/hr (80 mg Bag **)**

6	**Chronic Obstructive Pulmonary Disease exacerbation (COPD)** 1. Ipratropium Bromide 2000 mcg (To Be Given As 500 mcg Every 4 Hourly) 2. Salbutamol Nebs 2.5- 5mg + Salif 10ml 3. Inj. Methylprednisolone 40–60 mg (higher dose of 125 mg can be given for *Severe Bronchospasm*) 4. Piggy Bag 5% Dextrose 5. Tab Clarithromycin 500mg **6.** Inj. Ceftriaxone 2000mg (In case If There Is Pneumonic Patch On X Ray Or Signs Of Consolidation On Physical Examination)	Ipratropium Nebulizer: 500-2000 mcg Salbutamol Nebulizer: 2.5-5mg Salif :5-10 ml Inj Methylprednisolone (40-125 mg) Piggy Bag 5% dextrose: For Dilution Tab. Clarithromycin: 500 mg Inj. Ceftriaxone: 2 g
7	**ASTHMA** 1. Salbutamol Neb 2.5-5mg 2. Salifi (NS) 10ml 3. Ipratropium Neb 1000mcg (To Be Given As 500 mcg every 4 Hourly 4. Inj.Methylprednisolone 40mg – 60 mg Higher Dose Of 125 mg Can Be Given For Acute Severe Asthma (Previously Called Status Asthmaticus) 5. Piggy Bag 50ml	Salbutamol Neb: 2.5-5mg Salifi:5-10ml Ipratropium Neb :500-2000 mcg Inj. Methylprednisolone:40-60 mg Piggy Bag : For Dilution
8	**Anaphylaxis/Allergic Reaction** 1. Inj.Hydrocortisone100mg 2. Inj.Clemistine2mg/Inj. Pheniramine 3. Inj. Ranitidine 50 mg 4. Piggy Bag 50ml	Inj.Hydrocortisone :100-250 mg Inj Pheniramine 45.4mg Inj Ranitidine 50mg Piggy Bag: For Dilution

GI: Gastrointestinal.

Table 2: Plan-Do-Study-Act (PDSA) chart for the project

Phase	Action
P- Plan	▪ The prime aim of this project was to provide safe and timely care to critical patients visiting emergency department of Aga Khan University Hospital.
D- Do	▪ Common emergency conditions were chosen after through discussion and mutual decision of all the common stakeholders involved in order entry, processing and dispensing. ▪ Then 8 common conditions standard orders with pre-selected mnemonics were defined in CPOE system. These pre-selected mnemonics also has description of therapeutic doses ranges, route of administration and drug strength as well. ▪ Introductory and refresher training every fortnightly was provided to all the physicians and pharmacist involved in patient care in Emergency department. ▪ All the physicians were asked to enter standard order pre-selected mnemonics for the selected medical conditions and standard order medication list was displayed on the physician prescribing screen as a reminder. ▪ All the pharmacist were advised to keep standard order pre-filled sets in pharmacy and dispense these pre-filled sets rather than filling them one by one after processing the order.
S- Study	▪ Medication order entry, processing and dispensing time before and after the implementation of pre-filled standard order medication from physician and pharmacist end
A-Act	▪ Approval from the Patient and therapeutic committee to

	implement these pre-filled medication standard orders for continuum of care.

Table 3: Effect of Standard order set on Medication Order Entry Time

Physician End	Timing Order (in seconds)		Mean Diff. X=(a)-(b)	95% Confidence interval	N	P-value
	Pre-Intervention (X ± SD) (a)	Post-Intervention (X ± SD) (b)				
Road Traffic Accident	92.5 ± 14.1	33.7 ± 7.3	58.8	(54.4-63.3)	30	<0.001
Chronic liver disease	74.2 ± 10.7	22.7 ± 5.7	51.5	(48.9-54.1)	30	<0.001
Hyperkalemia	99 ±16.2	20.6 ± 3.7	78.5	(72.6-84.4)	30	<0.001
COPD	56.7 ± 15.3	17.6 ± 3.5	39.1	(33.8-44.5)	30	<0.001
Aspiration Prophylaxis	45.1 ± 10.2	16.9 ± 4.1	28.2	(25.0-31.3)	30	<0.001
Allergic Reaction	49.2 ± 4.5	16.3 ± 3.7	32.9	(31.0-34.8)	30	<0.001
Bleeding Prophylaxis	70.5 ± 10.2	19.5 ± 3.9	51.0	(47.7-54.2)	30	<0.001
Asthma	54.8 ± 17.6	16.7 ± 4	38.1	(32.3-43.9)	30	<0.001
Over All	67.7 ± 22.7	20.5 ± 7.1	47.3	(44.8 - 49.7)	240	<0.001

COPD: Chronic obstructive pulmonary disease SD: Standard deviation.

Table 4: Effect of Standard Order Sets on Medication Processing and Dispensing Time at Pharmacist End.

Pharmacist End	Timing Order (in seconds)		Mean Diff. X=(a)-(b)	95% Confidence interval	N	P-value
	Pre-Intervention (X ± SD) (a)	Post-Intervention (X ± SD) (b)				
Road Traffic Accident	67.3 ± 9.8	17.7 ± 3.3	49.7	(45.7 - 53.6)	30	<0.001
Chronic liver disease	103.7 ± 16	38.1 ± 8	65.6	(60.9 - 70.2)	30	<0.001
Hyperkalemia	103.8 ± 13.9	15.7 ± 3.6	88.1	(83.0 - 93.3)	30	<0.001
COPD	56.3 ± 6.9	15.7 ± 2.2	40.6	(38.0 - 43.2)	30	<0.001
Aspiration Prophylaxis	62.6 ± 6.8	14.5 ± 1.7	48.0	(45.9 - 50.2)	30	<0.001
Allergic Reaction	51.3 ± 5.1	18.2 ± 3.8	33.1	(31.0 - 35.2)	30	<0.001
Bleeding Prophylaxis	62.9 ± 10.6	29 ± 2.8	34.0	(30.2 - 37.7)	30	<0.001
Asthma	53.4 ± 8.4	15.5 ± 2.3	37.9	(34.9 -40.9)	30	<0.001

COPD: Chronic obstructive pulmonary disease SD: Standard deviation.