Pediatrics Standardized Concentration of Antibiotics Intravenous Infusion: A New Initiative in Saudi Arabia

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ABSTRACT

Objectives: To declare the pediatrics and neonates standardized concentration of antibiotics intravenous infusion as new initiatives in the Kingdom of Saudi Arabia. **Methods:** It is a new initiative project drove by national standardized concentration of antibiotics services. The projects formulated from the international business model, pharmacy project guidelines and project management institution guidelines of a new project. The initiative project is written through project management professionals and contained of several parts, including the initial phase, the planning phase, the execution phase, the monitoring and controlling phase. **Results:** The pediatrics and neonates standardized concentration of antibiotics intravenous infusion services defined as a vision, mission and goals. The services had various benefits including clinical and economic on patients, the continuous of the project assured by risk management model description and the monitoring and controlling of the services as explored in the review. The transition to operation project though closing project stage established in the analysis. **Conclusion:** The pediatrics and neonates standardized concentration of antibiotics intravenous infusion services are a new initiative part of the intravenous admixture program. The pediatrics and neonates standardized concentration of antibiotics will prevent drug related misadventures and implement of patient safety at healthcare organizations; it is highly recommended to implement in the Kingdom of Saudi Arabia.

Keywords: Pediatrics, Neonates, Standardized, Concentration, Antibiotics, Intravenous, Saudi Arabia.

INTRODUCTION

Antibiotics are widely used locally and internationally.[1-4] There is a high consumption of antibiotics, which is the Kingdom of Saudi Arabia, especially in adult patients. Besides, antibiotics consumption was high in neonates and pediatrics.[1-4] Parental antibiotics most consumption at critical care and inpatient wards units, while the oral antibiotics are widely used at ambulatory care and emergency services.[1-4] The most antibiotics consumption was a very broad spectrum with the subsequent high economic burden on the healthcare system.[3,4] The parenteral antibiotics need preparation in multiple diluent solutions and various concentration based on local or international guidelines. As a result, the high workload of intravenous admixture preparations and properly-highly incidence of medication errors. The American Society of Health-System Pharmacists recommended the appropriate preventive measure of medication mistakes to the standardized concentration of medications, including the antibiotics for adults or pediatrics and neonatal patients.[5,6] Several studies showed the benefits of standardized concentration in mistakes reductions.[7-11] The pediatrics and neonates standardized concentration of medications with an emphasis on antibiotics not existed locally or Gulf and Middle East countries. The aim of the project is to review the standardized concentration of antibiotics in the Kingdom of Saudi Arabia.

Method of the Project

It is a new initiative project drove from the national IV admixture and chemotherapy program.[12] The task force team of pediatrics and neonates standardized concentration of antibiotics intravenous formulated and contained from the author's expertise in the parenteral medications. The committee utilized and drove the pharmacy parenteral administration guidelines and from the textbook and international literature pediatrics and neonates standardized concentration of antibiotics intravenous written by utilizing the international business model, pharmacy project guidelines and project management institution guidelines of a new project.[13-16] The pediatrics and neonate's standardized concentration of antibiotics intravenous infusions adjusted based on the acceptable concentration, daily dose and the volume of bag as possible. The project is written through project management professionals and contained of several parts, including the initial phase, the planning phase, the execution phase, the monitoring and controlling phase.

Initiative Phase Assessment Needs

The majority of the intravenous admixture services in the Kingdom of Saudi Arabia had a manual of parenteral medication preparation.

The manual contained of antibiotics medications, route of administration, the rage of concentration, stability and compatibilities. The pharmacist and pharmacy technician prepares different antibiotics medications with various concentration and multiple diluent solution. Also, the physician and nurses are conducting the various route of administration with different concentrations and many solutions. Through those factors, the workload can be increased through prescribing or dispensing and administration of pediatrics and neonatal antibiotics medications. Also, the increments of the workforce might lead to safety discrepancies and medication mistakes. If the pediatrics and neonates standardized concentration of antibiotics intravenous infusions with unique solution appropriately diminution the workload and medications errors prevention.

SWOT Analysis

The most quality management tool used for the new project foundation was SWOT. It stands for strength, weakness, opportunities and threats. The most strength points of the pediatrics and neonate's standardized concentration of antibiotics intravenous infusions project are medication errors, preventive measures, reductions in pharmacy workload and healthcare providers, while the weak points are antibiotics medication contraction and the diluted solution is not widely used. The opportunities points are implemented quality policy and accreditation program. The threat points are the non-availability of a healthcare leader and the non-implementation of the pharmacy strategic plan.

Market Analysis

Most of the parenteral admixture services had a specific method of antibiotics intravenous medications. The guidelines of preparation contained of medications, route of administration, the stability of preparation, concentration and medication compatibility. The majority of the healthcare institutions had the same guideline with different medications. The pediatrics and neonate's standardized concentration of antibiotics intravenous infusions or standardized diluent solution has not happened. The pediatrics and neonate's standardized concentration of antibiotics intravenous infusions are an excellent method to inspire the manufacturers to produce the same ready-made, standardized concentration. However, there were some ready-made medications with specific concentration a variable in the market but coveted all antibiotics medications and the concentration was not suitable.

Planning Phase

Scope of the Project

The project contained the pediatrics and neonatal standardized concentration of antibiotics with specific diluent solutions. The concentration drove from typical daily dose and frequency administration. The pediatrics and neonate's standardized concentration of antibiotics intravenous inspires the pharmaceutical companies to make ready-made antibiotics with resembling concentration and diluent solution.

Vision, Missions, Goals

The vision of the project defined to reach the best with high quality of pediatrics and neonatal standardized concentration of antibiotics intravenous infusions, while the message to provide high-quality antibiotics with specific concentrations with an appropriate diluent solution. The goal of the project is to prevent medications errors of antibiotics for pediatrics and neonates, to reduce the workload of pharmacy and other allied professionals, to avoid the additional cost of pediatrics and neonatal antibiotic preparations and to encourage the pharmaceutical companies of producing the ready standardized antibiotics concentration for pediatrics or neonates.

Project Description

The following policies were put in place for every pharmacist and other health care individuals:[17,18]

- ✓ The pediatrics and neonate's standardized concentration of the antibiotics committee should be formulated at healthcare organizations.
- ✓ The pediatrics and neonates standardized concentration of antibiotics committee should consist of pediatrics IV pharmacist and pharmacy technician, pediatrics physician and nurse representative, neonatal physician and nurse representative
- ✓ The committee revises the pediatrics and neonate's standardized concentration of antibiotics intravenous infusions and updates at least annually.
- ✓ The pediatrics and neonate's standardized concentration of antibiotics intravenous infusions education and training sessions should be conducted by the committee to all healthcare providers, including physicians and nurses, with pharmacy staff.
- ✓ The pediatrics and neonates standardized concentration of antibiotics intravenous infusions distributed to healthcare sectors at the institutions (Table 1).
- ✓ The physician writes the prescription based on the pediatrics and neonates standardized concentration of antibiotics intravenous infusions.
- ✓ If the physician wishes to prescribe outside the pediatrics and neonates a standardized concentration of Antibiotics intravenous infusions guidelines, he should document the justification.
- ✓ The prescription should send to the pharmacy and pediatrics IV pharmacist and pharmacy technician will prepare it based on the pediatrics and neonates standardized concentration of antibiotics intravenous infusions guidelines.
- ✓ The pharmacy staff sends the medications to the nursing department and the nurse administers the medications based on the pediatrics and neonate's standardized concentration of Antibiotics intravenous infusions guidelines.
- ✓ The pharmacy department should measure the clinical outcome of the pediatrics and neonate's standardized concentration of antibiotics intravenous infusions.
- ✓ The pharmacy department should measure the economic outcome of the pediatrics and neonate's standardized concentration of antibiotics intravenous infusions.
- ✓ The pharmacy department should document any prescription non-adherence to the pediatrics and neonate's standardized concentration of antibiotics intravenous infusions.

Plan Cost Management

The fiscal budget should be detailed in every new project. The cost involved the educational courses, the management team meeting and updated references. Furthermore, the budget should be supervision for each period.

Executing Phase

Management Team

The pediatrics and neonate's standardized concentration of antibiotics intravenous infusions project might lead by the administration team. The team contained of infectious diseases pediatrics clinical pharmacist, pediatrics intravenous admixture pharmacist and pharmacy technician, pediatric infectious disease, pharmacy total quality management and pediatrics medications safety pharmacist. The team will implement and monitor the project, set-up the performance indicators and policies and procedures. In addition to updating pediatrics and neonates, the standardized concentration of antibiotics intravenous infusions list periodically and perform all education and training of the project for pharmacists, healthcare providers and related issues.

Table 1: Suggested Pediatrics and Neonates Standardized Concentration of Antibiotics Intravenous Infusion.[22-32]

No	Generic Name	Initial Strength	Diluents (preferable)	Reconstitution Volume	Final Concentration IVBP	Final Preparation with Standard Concentration	Maximum Conc.	Final Preparation With Maximum Concentration	Stability of Solution RT	Stability of Solution Ref	Rate of Administration IVBP
1	Acyclovir	25mg/ml	D5W NS	10 ml SWFI	5mg/ ml	250 mg/ 50 ml NS 250 mg/ 50 m D5W 25 mg/ 10 ml NS 25 mg/ 10 m D5W	7mg/ ml	250 mg/ 25 ml NS 250 mg/ 25 ml D5W 25 mg/ 5 ml NS 25 mg/ 5 m D5W	24 hrs	NA	60 mint
2	Amikacin	25mg/ml 50 mg/ml 125mg/ml 250mg/ml	D5W NS	NA	0.2 mg/ml	250 mg/ 100 ml NS 250 mg/ 100 m D5W 25 mg/ 10 ml NS 25 mg/ 10 m D5W	5mg/ ml	250 mg/ 50 ml NS 250 mg/ 50 m D5W 25 mg/ 5 ml NS 25 mg/ 5 m D5W	24 hrs	48 hrs	30–60 mint
3	Amoxacillin/ Claulenic Acid 600mg/10ml	60mg/ml	NS	SWFI	12mg/ml	600mg/50ml NS 300mg/50ml NS 150mg/10ml NS	120mg/ml	600mg/25ml NS 300mg/25ml NS 150mg/5ml NS	4 hrs	8 hrs	30-40 mint
4	Ampicillin	250mg/2.5ml 500mg/5ml 1000mg/10ml 2000mg/20 ml	NS	5-10 ml SWFI	20mg/ml	250mg/50ml NS 50mg/10ml NS	30mg/ml	250mg/25ml NS 50mg/5ml NS	8 hrs	24 hrs	30-60 mint
5	Amphotericin B	5mg/ ml	D5W	10 ml SWFI	0.1mg/ ml	25mg/250ml D5W 10mg/100ml D5W	0.25mg/ ml Use central line	25mg/ 100ml D5W 10mg/50ml D5W	24 hrs	2 days	4-6 hrs
6	Amphotericin B Lipid complex	5mg/ml	D5W	NA	1mg/ml	100mg/100ml D5W 10mg/10ml D5W	2mg/ml	100mg/50ml D5W 10mg/5ml D5W	6 hrs	2day	2.5 mg/kg/hr or 2 hrs
7	Azithromycin	100 mg/ml	D5W NS	4.8 ml SWFI	1mg/ml	250 mg/250ml NS 250 mg/250ml D5W 10 mg/10 ml NS 10 mg/10 ml D5W	2 mg/ml	250 mg/100ml NS 250 mg/100ml D5W 10 mg/5 ml NS 10 mg/5 ml D5W	24 hrs	7 days	3 hrs
8	Caspofungin more than 3 months	5mg/ ml 7mg/ ml	NS	10.5 ml SWFI	0.14mg/ ml	35mg/ 250ml NS 25mg/ 250ml NS	0.3mg/ ml	35mg/ 250ml NS 25mg/ 250ml NS	24 hrs	48 hrs	60 mint
9	Cefazoline	100mg/ml	D5W NS	10ml SWFI	20mg/ ml	250mg /25ml NS 250mg /25ml D5W 50mg /5ml NS 50mg /5ml D5W	100/ml	250mg /25ml NS 250mg /25ml D5W 50mg /2.5ml NS 50mg /2.5ml D5W	24 hrs	10 days	10-60 mint

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10	Cefepime 2 months and above	100-160/ml	D5W NS	10ml SWFI	20mg/ ml	250mg /25ml NS 250mg /25ml D5W 50mg /5ml NS 50mg /5ml D5W	40mg/ ml	250mg /25ml NS 250mg /25ml D5W 50mg /2.5ml NS 50mg /2.5ml D5W	24 hrs	7 days	30 mint
11	Cefotaxime	100mg/ ml	D5W NS	10ml SWFI	20mg/ ml	250mg /25ml NS 250mg /25ml D5W 50mg /5ml NS 50mg /5ml D5W	100/ml	250mg /25ml NS 250mg /25ml D5W 50mg /2.5ml NS 50mg /2.5ml D5W	24 hrs	5 days	15-30 mint
12	Ceftazidime	100mg/ml	D5W NS	10ml SWFI	10mg/ ml	250mg /25ml NS 250mg /25ml D5W 50mg /5ml NS 50mg /5ml D5W	40mg/ ml	250mg /25ml NS 250mg /25ml D5W 50mg /2.5ml NS 50mg /2.5ml D5W	NA	24 hrs	15-30 mint
13	Ceftriaxone	100mg/ml	D5W NS	9.6 ml SWFI	10mg/ ml	250mg /25ml NS 250mg /25ml D5W 50mg /5ml NS 50mg /5ml D5W	40mg/ ml	250mg /25ml NS 250mg /25ml D5W 50mg /2.5ml NS 50mg /2.5ml D5W	2 days	10 days	30-60 mint Pediatrics 30 mint Neonates 60 mint
14	Cefuroxime 3 month and above	100mg/ml	D5W NS	7.2 ml SWFI	7.5mg/ ml	250mg /25ml NS 250mg /25ml D5W 50mg /5ml NS 50mg /5ml D5W	15mg/ ml	250mg /25ml NS 250mg /25ml D5W 50mg /2.5ml NS 50mg /2.5ml D5W	24 hrs	7 days	15-30 mint
15	Cephradine 9 month and older	100mg/ml	D5W NS	5-10 ml SWFI	100mg/ ml	250mg /10ml NS 250mg /10ml D5W 50mg /5ml NS 50mg /5ml D5W	200mg/ ml	250mg /5ml NS 250mg /5ml D5W 50mg /2.5ml NS 50mg /2.5ml D5W	24 hrs	24 hrs	30 mint
16	Ciprofloxacine	2mg/ ml	NS D5W	NA	0.2mg/ ml	150mg/75ml NS 150mg/75ml D5W 10 mg/5ml NS 10 mg/5ml D5W	2mg/ ml	150mg/75ml NS 150mg/75ml D5W 10 mg/5ml NS 10 mg/5ml D5W	14 days	14 days	60 mint
17	Clindamycin	150mg/ ml	D5W NS	NA	6mg/ ml	75mg/10ml NS 75mg/10ml D5W 15mg/ 3ml D5W 15mg/ 3ml NS	18mg/ ml	75mg/5ml NS 75mg/5ml D5W 15mg/ 1ml D5W 15mg/ 1ml NS	16 Days	32 Days	30-60 mint

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18	Cloxacillin	100mg/ ml	D5W NS	2.5-4.8 ml SWFI	20mg/ ml	500/ 50ml D5W 500/ 50ml NS 250/ 25ml D5W 250/ 25ml NS	50mg/ ml	500/ 25ml D5W 500/ 25ml NS 250/ 10ml D5W 250/ 10ml NS	4 hrs	In NS 24 hrs In D5w 8 hrs	30 mint
19	Erythromycin 500mg	50mg/ ml	NS	10-20 ml SWFIè	1mg/ ml	500mg/ 500ml NS 250mg/ 250ml NS 20mg/ 20ml NS 10mg/ 10ml NS	5mg/ ml	500mg/ 250ml NS 250mg/ 100ml NS 20mg/ 10ml NS 10mg/ 5ml NS	8 hrs	24hrs	60 mint
20	Flucloxacillin	250mg powder	NS D5W	5 mL WFI	5mg/ ml	500/ 50ml D5W 500/ 50ml NS 250/ 25ml D5W 250/ 25ml NS	20mg/ml	500/ 25ml D5W 500/ 25ml NS 250/ 15ml D5W 250/ 15ml NS	2 hrs	24 hrs	30 mint
21	Fluconazole	200mg/100ml 400mg/200ml Premixed	NA	NA	2mg/ml	50mg/25ml 10mg/5ml	2mg/ml	50mg/25ml 10mg/5ml	NA	N/A	60 mint
22	Gancyclovir	50mg/ ml	D5W NS	10 ml SWFI	5mg/ ml	100mg/ 25ml D5W 100mg/ 25ml NS 10mg/ 5ml D5W 10mg/ 5ml NS	10mg/ ml	100mg/ 25ml D5W 100mg/ 25ml NS 10mg/ 2ml D5W 10mg/ 2ml NS	12 hrs	24 hrs	60 mint
23	Gentamicin Regular dose	10mg/ ml 40mg /ml	D5W NS	NA	0.8 mg/ml	40mg/25ml D5W 40mg/25ml NS 2mg/5ml D5W 2mg/5ml NS	4 mg/ml	40mg/25ml D5W 40mg/25ml NS 2mg/2.5ml D5W 2mg/2.5ml NS	48 hrs	48 hrs	30-60 mint
24	Gentamicin Single daily dose	10mg/ ml 40mg /ml	D5W NS	NA	0.8 mg/ml	120mg/100ml D5W 120mg/100ml NS 6mg/10ml D5W 6mg/10ml NS	4 mg/ml	120mg/50ml D5W 120mg/50ml NS 6mg/5ml D5W 6mg/5ml NS	48 hrs	48 hrs	16-18 hrs
25	Imipenem/ cilastatin sodium	50mg/ ml vial 500mg/100 ml premix	D5W NS	10 ml SWFI	5mg/ ml	250mg/ 50ml NS 250mg/ 50ml D5W 25mg/ 5ml NS 25mg/ 5ml D5W	5mg/ ml	250mg/ 50ml NS 250mg/ 50ml D5W 25mg/ 5ml NS 25mg/ 5ml D5W	4 hrs with d5% 10hr with NS	24 hrs with d5% 48hr with NS	Over 30 mint

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26	Levofloxacin Premixed 500mg/100ml 6 months and above	5mg/ml	D5W NS	NA	2mg/ml	150mg/75ml NS 150mg/75ml D5W 10 mg/5ml NS 10 mg/5ml D5W	5mg/ ml	125mg/25ml NS 125mg/25ml D5W 10 mg/2.5ml NS 10 mg/2.5ml D5W	72 hrs	14 days	60-90 mint
27	Linezolid Premixed 600mg/300ml bag	2mg/ml	NA	NA	2mg/ ml	150mg/75 ml 12mg/6ml	2mg/ ml	150mg/75 ml 12mg/6ml	Use fresh	NA	30–120 mint
28	Meropenem 500mg	50mg/ ml	NS	10 ml SWFI	1mg/ml	500/ 100ml NS 50/ 10ml NS	20mg/ml	500/ 50ml NS 50/ 5ml NS	1 hrs	15 hrs	30 mint
29	Metronidazole 500mg/100ml	5mg/ml	NA	NA	5mg/ ml	250mg/ 50ml 25mg/5 ml	5mg/ ml	250mg/ 50ml 25mg/5 ml	Use fresh	NA	Over 60 mint
30	Micafungin sodium 50mg	10mg/ ml	NS D5W	5 mL NS or D5W	0.5mg/ml	50mg/50ml NS 50mg/50ml D5W 10mg/20ml NS 10mg/20ml D5W	4mg/ml	50mg/25ml NS 50mg/25ml D5W 10mg/10ml NS 10mg/10ml D5W	24 hrs	NA	60 mint
31	Moxifloxacin	1.6mg/ ml	NA	NA	1.6mg/ ml	80mg/ 50ml 32mg/ 20ml	1.6mg/ ml	80mg/ 50ml 32mg/ 20ml	Use fresh	NA	60 mint
32	Penicillin G sodium	200000U/ ml	D5W NS	4.6 ml SWFI	50,000U/ ml	2MU/ 50ml D5W 2MU/ 50ml NS 100,000/ 5ml D5W 100,000/ 5ml NS	100,000U/ ml	2MU/ 25ml D5W 2MU/ 25ml NS 100,000/ 2.5ml D5W 100,000/ 2.5ml NS	24 hrs	7 days	15-30 mint
33	Piperacillin/ Tazobactam	225mg/ ml	D5W NS	10 ml SWFI	20mg/ ml	2.25g/ 100ml D5W 2.25g/ 100ml NS 1.125g/ 50ml D5W 1.125g/ 50ml NS	80mg/ ml	2.25g/ 50ml D5W 2.25g/ 50ml NS 1.125g/ 25ml D5W 1.125g/ 25ml NS	24 hrs	48 hrs	30 mint
34	Rifampicin	60mg/ ml	D5W	10 ml SWFI	1.2mg/ ml	300mg/ 100ml NS 150mg/ 100ml NS 60mg/ 30ml NS	6mg/ ml	300mg/ 50ml NS 150mg/ 25ml NS 60mg/ 15ml NS	4 hrs	NA	3 hrs

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35	Sulfamethoxazole + Trimethoprim	SMX 80mg/ml + TMP 16mg/ml	D5W	NA	0.64mg/ ml	2ml/50ml D5W 0.25ml/10ml D5W 0.5ml/20ml D5W	1.07mg/ ml	2ml/50ml D5W 0.25ml/5ml D5W 0.5ml/10ml D5W	2-6 hrs	NA	60-90 mint
36	Vancomycin	50mg/ ml	D5W NS	10 ml SWFI	5mg/ ml	250mg/ 100ml D5W 250mg/ 100ml NS 25mg/ 10ml D5W 25mg/ 10ml NS	10mg/ ml	250mg/ 50ml D5W 250mg/ 50ml NS 25mg/ 5ml D5W 25mg/ 5ml NS	24 hrs	24hrs	2 hrs

Abbreviations: IVBP: Intravenous Piggyback, NA: Not Applicable/ Not available, NS: Normal Saline, Ref: Refrigerate, RT: Room Temperature, SWFI: Sterile Water For Injection, Hrs :hours, Mint: Minutes

Note: The healthcare professionals should adjust the concentration and the dose requirement according to the patient condition

The pharmacist should the review the appreciate concentration of final preparations according the strength of the medications, prescribing dose, and their local healthcare institution policy

Education and Training

Many educational and training sessions about pediatrics and neonate's standardized concentration of antibiotics intravenous infusions should be done for pharmacy staff, including pharmacists and pharmacy technicians. Also, healthcare providers, including physicians and nurses, should obtain education and training before starting the project. Another candidate for pediatrics and neonates standardized concentration of antibiotics intravenous infusions education courses, the management team and proper orientation for new pharmacy or healthcare staff join the healthcare organization.

Monitoring and Controlling Phase Project

Total Quality Management

In the current project, antibiotics, the standardized concentration of antibiotics medications for total quality monitoring, is Balance Scored Card.[19] It contained of the customer, finance, internal process, education and innovation types. The customer type might measure the patient's satisfaction with a standardized concentration of antibiotics. Also, pharmacy staff and healthcare providers can be measured the satisfaction of the project. The assessment of healthcare services of patients and neonatal standardized concentration of antibiotics through internal process type. The type of education and innovation types, the measures of clinical outcome of pediatrics and neonatal standardized concentration of chemotherapy medications explored the education and competency of pharmacy staff. The measurement of economic analysis of pediatrics and neonatal standardized concentration of antibiotics through financial type; the measurements of the clinical impact of pediatrics and neonatal standardized concentration of antibiotics explored the education and competency of pharmacists and pharmacy technicians through education and innovation type.

Risk Management

Various types of risk management involved budget risks, scope risks, schedule risks, personal risks, technical risks and quality risks.[20,21] The most common exposed risks to the project were personnel, budget, technical and quality risks. The project might have personal risks for an instant shortage of pharmacy staff or not trained pharmacists or pharmacy technicians. The second risk was the budget types included not enough budget for education and training or update resources. The technical risk might have non-available for computerized or electronic prescribing. The other risk that may be exposed to the quality risks with involvement and not implemented the medications safety program or not available quality management pharmacist or pharmacy technician.

Closing of the Project

The pediatrics and neonatal standardized concentration of chemotherapy at all healthcare governmental and private organizations is highly optional to prevent medication errors that might lead to mortality. Also, to avoid needless economic burden on hospitals and primary healthcare centers in the Kingdom of Saudi Arabia. The project should continue at chemotherapy IV admixture at each pharmacy services and related committees. The pediatrics and neonatal education and training for standardized concentration should be done frequently and update drug concentration and extended parental medications necessary in the future. The annual celebration of all pediatrics and neonatal pharmacist and pharmacy technician staff is highly suggested in the Kingdom of Saudi Arabia.

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CONFLICT OF INTEREST

None.

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CONSENT FOR PUBLICATIONS

Informed consent was obtained from all the participants

ETHICAL APPROVAL

This research exempted from research and ethical committee or an institutional review board (IRB) approval.

https://www.hhs.gov/ohrp/regulations-and-policy/decision-charts-2018/index.html

ABBREVIATIONS

MOH: Ministry of Health; **KSA:** Kingdom of Saudi Arabia; **ASHP:** American Society of Health-System Pharmacists; **SWOT:** Strengths, Weaknesses, Opportunities and Threats; **IV:** Intravenous; **BSC:** Balance Scored Cards.

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REFERENCES

1. Almasoudi AH, Alomi YA, Alghamdi GA. Antimi-

crobial drug consumption in ambulatory care settings, Tabuk Region, Saudi Arabia. Pharmacol Toxicol Biomed Reports. 2019;5(3):97-101.
2. Alomi YA, Almasoudi AH, Alghamdi GA, *et al*. Antimicrobial drug consumption in emergency services at North West (Tabuk) Region Hospitals, Saudi Arabia. Pharmacol Toxicol Biomed Reports. 2019;5(3):108-12.
3. Alomi YA, Almasoudi AH, Alghamdi GA, *et al*. Analysis of antimicrobial medication consumption in intensive care unit, North West (Tabuk) Region Hospitals, Saudi Arabia. Pharmacol Toxicol Biomed Reports. 2019;5(3):119-23.
4. Almasoudi AH, Alomi YA, Alghamdi GA, *et al*. Analysis of antimicrobial medications consumption in inpatient units at North West (Tabuk) Region Hospitals, Saudi Arabia. Pharmacol Toxicol Biomed Reports. 2019;5(3):130-4.
5. American Society of Health-System Pharmacists. Standardized Concentrations: Adult Continuous IV Infusions Version 1.01. 2016. Available from https://www.ashp.org/-/media/assets/pharmacy-practice/s4s/docs/s4s-iv-adult-continuous-infusion-guiding-principles.ashx
6. Traynor K. Medication standardization effort aims to improve patient safety. American Society of Health-Systems Pharmacy. 2016;1121.
7. Murray KL, Wright D, Laxton B, *et al*. Implementation of standardized pediatric i.v. medication concentrations. Am J Heal Pharm. 2014;71(17):1500-8.
8. Hilmas E, Sowan A, Gaffoor M, *et al*. Implementation and evaluation of a comprehensive system to deliver pediatric continuous infusion medications with standardized concentrations. Am J Heal Pharm. 2010;67(1):58-69.
9. Bullock J, Jordan D, Gawlinski A, *et al*. Standardizing IV infusion medication concentrations to reduce variability in medication errors. Crit Care Nurs Clin North Am. 2006;18(4):515-21.
10. Nemec K, Kopelent-Frank H, Greif R. Standardization of infusion solutions to reduce the risk of incompatibility. Am J Heal Pharm. 2008;65(17):1648-54.
11. Westerkamp T. Standardized concentrations for intravenous drip medications. Am J Hosp Pharm. 1988;45(9):1862.
12. Alomi YA. National Intravenous (IV) Therapy Program at MOH in Saudi Arabia. EC Pharm Sci. 2016;3(2.3):307-11.
13. McDonough R. Writing a business plan for a new pharmacy service. The Dynamics of Pharmaceutical Care: Enriching Patients' Health. 2010;23:1-2.
14. Harris IM, Baker E, Berry TM, *et al*. Developing a business-practice model for pharmacy services in ambulatory settings. Pharmacotherapy. 2008;28(2):7e-34e.
15. Sachdev G. Sustainable business models: Systematic approach toward successful ambulatory care pharmacy practice. Am J Heal Pharm. 2014;71(16):1366-74.
16. PMBOK Guide. A guide to the project management body of knowledge. Sixth Edition. Project Management Institute Inc. 2017.
17. Mitchell A, Sommo P, Mocerine T, *et al*. A standardized approach to pediatric parenteral medication delivery. Hospital Pharmacy. 2004;39(5):433-59.
18. Sowan AK, Vaidya VU, Soeken KL, *et al*. Computerized orders with standardized concentrations decrease dispensing errors of continuous infusion medications for pediatrics. J Pediatr Pharmacol Ther. 2010;15(3):189-202.
19. Kaplan RS, Norton DP. The balanced scorecard: Measures that drive performance. Harvard Business Review. 2005;83(7):172. Cited 2020 Mar 15. Available from: https://hbr.org/1992/01/the-balanced-scorecard-measures-that-drive-performance-2.
20. Ray S. The risk management process in project management: Project Manager. Risk Management. 2017. Cited 2020 Mar 15. Available from: https://www.projectmanager.com/blog/risk-management-process-steps.
21. Kaplan RS, Mikes A. Managing Risks: A New Framework. Harvard Business Review. 2012;90(6):48-60. Cited 2020 Mar 15. Available from: https://hbr.org/2012/06/managing-risks-a-new-framework.
22. Ministry of Health. Ministry of Health Formulary. Health Ministry of Health. 2012.
23. Saudi Food and Drug Authority. List of human medicine and herbal health. 2019. [cited 2019 Jun 17]. Available from: https://www.sfda.gov.sa/en/drug/resources/Pages/DrugsUnderRegistrations.aspx
24. Baxter K, Aikman K, Luckhurst R, *et al*. British National Formulary 78 (BNF). Royal Phamaceutical Society. 2019;1-1701.
25. Alomi YA, *et al*. Pediatrics Parenteral Dilution Manual. Ministry of Health. 2015. Available from: https://www.researchgate.net/publication/281710402_Pediatrics_Parenteral_Dilution_Manual
26. Alomi YA, *et al*. Neonates Parenteral Dilution Manual. Ministry of Health. 2015. Available from: https://www.researchgate.net/publication/281710411_Neonates_Parenteral_Dilution_Manual
27. Wolters Kluwer Clinical Drug Information. Inc. (Lexi-Drugs). Wolters Kluwer Clinical Drug Information, Inc. 2020.
28. Drugs.com. Drugs.com, Prescription Drug Information, Interactions and Side Effects. Drugs.com. 2020. [cited 2020 Jun 16]. Available from: https://www.drugs.com/
29. King Abdulaziz Medical City. Unified IV Manual. 2020.
30. Wolters Kluwer Clinical Drug Information. Inc. (ASHF Essentials adults and pediatrics). Wolters Kluwer Clinical Drug Information, Inc. 2020.
31. Wolters Kluwer Clinical Drug Information. Inc. (Pediatrics and Neonatal Lexi-Drugs). Wolters Kluwer Clinical Drug Information, Inc. 2020.
32. Wolters Kluwer Clinical Drug Information. Inc. (Nursing Lexi-Drug). Wolters Kluwer Clinical Drug Information, Inc. 2020.