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

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ABSTRACT

Objectives: To declare the pediatrics and neonates’ standardized concentration of miscellaneous medications intravenous infusion as new initiatives in the Kingdom of Saudi Arabia. Methods: It is a new initiative project drove by national standardized concentration of miscellaneous medications intravenous infusion 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 miscellaneous medications intravenous infusion services with a defined vision, mission and goals. The services had multiple 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 declared as explored in the review. The transition to operation project though closing project stage demonstrated in the analysis. Conclusion: The pediatrics and neonates’ standardized concentration of miscellaneous medications intravenous infusion services is a new initiative as part of the intravenous admixture program. The pediatrics and neonates’ standardized concentration of miscellaneous medications intravenous infusion might improve patient outcome and avoid added unnecessary cost; it is highly recommended to implement in the Kingdom of Saudi Arabia.

Keywords: Pediatrics, Neonates’, Standardized, Concentration, Miscellaneous, Intravenous, Services, Saudi Arabia.

INTRODUCTION

The medication errors prevention is vital in the neonatal and pediatrics field. The pharmacist had a crucial role in the intervention and medication mistakes prevention of neonates’ and pediatrics patients in Saudi Arabia. Besides, the pharmacist properly decreases the economic burden on the pharmacy and healthcare system.

The majority of mistakes were dosing related and measured as the third type of errors. Various medications involved in mistakes, not specialized groups of medications. Multiple literatures discussed pediatrics and neonate’s standardized concentration of high-risk medications. It included cardiopulmonary medication, electrolyte and total parenteral nutrition for neonates’ and pediatrics. However, some miscellaneous medications not discussed in those literatures. The authors were not familiar with any investigations based on their knowledge discussed the pediatric or neonatal standardized concentration of miscellaneous medications not involved antibiotics, chemotherapy, cardiovascular medications and central nervous system medications. The aim of the current review is to declare the neonatal and pediatrics standardized concentration of intravenous infusion of miscellaneous medication as new initiatives project in the kingdom of Saudi Arabia.

Method of the Project

It is a new initiative project drove by the national IV admixture programs. The task force team of pediatrics and neonates’ standardized miscellaneous medications concentration formulated and contained from the author’s expertise in the parenteral medications. All antibiotics, chemotherapeutic agent CNS medications, cardiovascular medications will be excluded from the revision. The committee utilized and drove the pharmacy parenteral administration guidelines, from the textbook and international literature pediatrics and neonates’ standardized concentration of miscellaneous medications. It was written by utilizing the international business model, pharmacy project guidelines and project management institution guidelines of a new project. The pediatrics and neonate’s standardized concentration adjusted based on the drug strength, acceptable concentration, daily dose and the volume of bag as possible. The project is written through project management professionals and entailed 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 pharmacy unit made guidelines for parenteral dilution and administration of the medications special for them. The guidelines comprised of medications, drug strength, rate of administration and stability of intravenous infusions. The pharmacists and pharmacy technician prepares multiple medications with various concentrations and different diluent solutions. Moreover, the healthcare providers, including physicians and nurses, might deal with a different method of administration with multiple concentrations and various solutions. The pediatricians and neonate’s standardized concentration of medications are essential to prevent drug-related errors. The workload of healthcare professionals might be enlarged through prescribing or dispensing and administration of multiple concentration medications. The various factors of the workforce may affect the safety culture and lead to medication errors. If the unified concentration with the solution will lessen the workload and prevent medication errors.

SWOT Analysis
The SWOT analysis measured one of the common tools for each new project analysis. The SWOT analysis stands for strength, weakness, opportunities and threats. The strengths points of the project are set up the medication safety and prevention of mistakes, reductions of pharmacy and healthcare provider workload, while the weak points are limited medication concentration and few numbers of diluent solution. The opportunities points are quality methods for accreditation and patient safety program implementation. The threat points are if the pharmacy strategic plan does not happen and if the administration planner not available.

Market Analysis
The majority of the intravenous admixture service had a specific method of parenteral medications. The manual of preparation comprised of medications, route of administration, the stability of preparation, with normal and maximum concentration and medication compatibility. Most of the governmental or private healthcare organizations had the same guideline with different medications. There is no standardized concentration for medications or standardized diluent solutions for pediatrics or neonates. It is a special method for standardized concentration to reassure pharmaceutical companies to manufacture the same, although some ready-made medications with specific standardized concentration a variable in the market.

Planning Phase
Scope of the Project
The project covers a pediatrics and neonate’s standardized concentration of miscellaneous intravenous infusions. It is not comprised antibiotics, cardiovascular medications, CNS medications and chemotherapy agents including common and maximum concentration based on the dosage, frequency administration and medications strength. Moreover, the diluent solution for pediatrics and neonates’ miscellaneous medications.

Vision, Missions, Goals
The vision of the project is to reach the best pediatrics and neonate's standardized concentration of intravenous infusion of miscellaneous medications, while the message to provide the appropriate pediatrics and neonates’ fixed standardized concentration of intravenous infusions of miscellaneous medications with appropriate diluent solutions. The goals of the project is to fix the pediatrics and neonates’ standardized concentration of intravenous infusion of miscellaneous medications, to inhibit any mistakes related to medication concentration, to reduce the workload for pharmacy staff, healthcare providers and to avoid the other needless and additional cost on the pharmacy and healthcare system.

Project Description
The following policies were put in place for every pharmacy staff and other health care individuals:

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

Plan Cost Management
Every new project, the management team must set out the financial budget, which includes the cost of educational courses pediatrics and neonate’s healthcare professionals, the cost of the management team meeting and the cost of updated references. The budget must be supervision over a while until the project ended and switch to the operating system.

Executing Phase
Management Team
Project management professionals had various steps. One of the essential steps was executing phase, which had a team lead the program or the project from the beginning until becoming one of the operating systems at a healthcare organization. The team contained of several members, including pediatrics medical clinical pharmacists, neonates’ clinical pharmacists, pediatrics and neonates’ medical physicians, pharmacists and pharmacy technician experts in the parenteral preparation, pharmacy quality management and medications safety officer representing. The team should
| No. | Generic medications | Initial Strength | Diluents | Reconstitution Volume | Final Concentration | Final Preparation with Maximum Concentration | Maximum Conc. | Final Preparation with Standard Concentration | Stability of mixed Solution | Rate of Administration IVPB |
|-----|---------------------|-----------------|----------|-----------------------|---------------------|-----------------------------------------------|---------------|-----------------------------------------------|-----------------------------|---------------------------|
| 1   | Acetaminophen       | 10mg/ml         | NA       | NA                    | 10mg/ml             | 250mg/25ml/500mg/50ml                         | 10mg/ml       | 250mg/25ml/500mg/50ml                        | 6 hrs                       | 15 mint                   |
| 2   | Azathioprine        | 100 mg          | D5W, NS  | 10 ml SWFI            | NA                  | 25mg/50ml D5W 50mg/50ml D5W                   | <10mg/ml      | 25mg/25ml D5W 50mg/25ml D5W                 | 16 days                     | 30-60 mint                |
| 3   | Basiliximab         | 20 mg           | D5W, NS  | 5 ml SWFI             | 0.4 mg/ml           | 10mg/25ml NS 20mg/50ml NS                     | NA            | 10mg/25ml NS 20mg/50ml NS                   | 24 hrs                      | 20-30 mint                |
| 4   | Cyclosporine        | 250mg/5ml       | NS, D5W  | NA                    | 0.5mg/ml            | 25mg/50ml D5W 50mg/100ml D5W                  | 2.5mg/ml      | 25mg/25ml D5W 50mg/100ml D5W               | 24 hrs                      | 2-6 hr                    |
| 5   | Dantrolene          | 20 mg injection | SWFI     | 60 ml                 | 0.33mg/ml           | 20mg/60ml D5W 20mg/60ml SWFI                  | 0.33mg/ml     | 20mg/60ml D5W 20mg/60ml SWFI               | 6 hrs                       | 60 mint                   |
| 6   | Dexamethasone       | 4mg/ml          | NS, D5W  | NA                    | 0.093mg/ml          | 1mg/25ml NS 4mg/25ml NS 6mg/25ml NS 10mg/25ml NS | 1mg/ml        | 2mg/25ml NS 8mg/25ml NS 12mg/25ml NS 20mg/25ml NS | 2 days                      | 15-60 mint                |
| 7   | Diphenhydramine     | 50mg/ml         | D5W, NS  | NA                    | 0.1mg/ml            | 15mg/25ml D5W 25mg/25ml D5W                   | Less than 50mg/ml | 15mg/10ml D5W 25mg/10ml D5W               | 24 hrs                      | 10-15 mint                |
| 8   | Human Soluble Insulin Regular | 100U/ml | NA       | NA                    | 0.5U/ml             | 10 units/20 ml NS 50 units/100ml NS 1U/ml     | 10 units/10 ml NS 50 units/100ml NS | 24 hrs                                | Titrated depend on Blood Glucose | 14 days                  |
### Table 1: Suggested Pediatrics Standardized Concentration of Miscellaneous Medications (17-27)

|   | Medication                        | Dosage       | Concentration | Strength | Volume | Administration | Time | Notes                                      |
|---|-----------------------------------|--------------|---------------|----------|--------|----------------|------|--------------------------------------------|
| 9 | Hydrocortisone Sodium Succinate   | 100mg or 500mg injection | D5W | 2 ml of NS for 100 mg and 10 ml for 500 mg | 10mg/10ml D5W 25mg/25ml D5W 50mg/50ml D5W 100mg/100ml D5W | 10mg/10ml NS 25mg/25ml NS 50mg/50ml NS 100mg/100ml NS | 4 hrs | 20-30 mint                                 |
| 10| Iron Dextran                      | 50mg/ml (2ml) | NS | NA | NA | 50mg/50ml NS 100mg/100ml NS | NA | 50mg/25ml NS 100mg/100ml NS | NA | NA | 2-6 hrs                                      |
| 11| Iron Saccharate                   | 100mg/5ml    | NS | NA | 1mg/ml | 2mg/ml | 7 days | NA | Each 100 mg over at least 30-60 minutes  |
| 12| Methylprednisolone Sodium succinate | 40 mg 500 mg | D5W | NA | NA | 20mg/50ml NS 30mg/50ml NS 250mg/50ml NS | NA | 20mg/25ml NS 30mg/25ml NS 250mg/25ml NS | 24 hrs | 24 hrs | 30-60 mint                                  |
| 13| Ondansetron                       | 2mg/ml (2 ml) | D5W | NA | NA | 2mg/25ml D5W 4mg/25ml D5W 2mg/25ml NS 4mg/25ml NS | 1mg/ml | 4mg/15ml D5W 8mg/15ml D5W | 2 days | 7 days | 15 mint                                     |
| 14| Pamidronate                       | 30 mg Injection | NS,D5W | 10 SWFI | NA | 15 mg/500 ml NS 30 mg/500 ml NS 15 mg/500 ml D5W 30 mg/500 ml D5W | NA | 15 mg/250 ml NS 30 mg/250 ml NS 15 mg/250 ml D5W 30 mg/250 ml D5W | 7 day | 30 days | 2-24 hrs                                   |
| 15| Pantoprazole                      | 40 mg Injection | NS,D5W | 10 NS | 0.4mg/ml | 20 mg/50 ml NS 40 mg/100 ml NS 20 mg/50 ml D5W 40 mg/100 ml D5W | 0.8mg/ml | 20 mg/25 ml NS 40 mg/50 ml NS 20 mg/25 ml D5W 40 mg/50 ml D5W | 24 hrs | 48 hrs | 15 mint                                     |

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 review the appreciate concentration of final preparations according to the strength of the medications, prescribing dose, and their local healthcare institution policy.
implement and follow up on the new services with regular updating of medications list with their concentration. Moreover, the team should educate and train the pharmacy, pediatrics and neonates’ staff about the new services and measure the clinical and economic outcome of the project.

Education and Training

Every new project entails special education and training for concern people. This project desires education and training for pharmacy staff, including pediatrics and neonates’ clinical pharmacists, pediatrics and neonates’ pharmacists and pharmacy technicians. The healthcare professionals, counting pediatrics and neonates’ physicians and nurses, need another special education and training. Moreover, the team management needs orientation education about the project for all healthcare professionals. The orientation emphasis on for any new staff healthcare providers joined the healthcare institutions.

Monitoring and Controlling Phase

Project Total Quality Management

There are numerous tools used for total quantity management with new project pediatrics and neonates’ standardized concentration of miscellaneous medications during the implementation phase and reflect the impact and the balance scored cards was among them. The tools monitor consisted of four-part that's including the customer, finance, internal process, education and innovation. The assessment of healthcare services of adult’s standardized concentration of miscellaneous medications was an example of an internal process type. The clinical outcome of pediatrics and neonates’ standardized concentration of miscellaneous medications, which may imitate the education and competency of pediatrics and neonates’ clinical pharmacists, distributive pharmacists and pharmacy technicians as an example of the education type. The financial type had another example of measuring the cost avoidance of the pediatrics and neonate’s standardized concentration of central nervous system medications. The fourth type was the customer types with measuring the patient’s satisfaction with healthcare providers, including pharmacists and pharmacy technicians of pediatrics and neonates’ standardized concentration of miscellaneous medications satisfaction in the Kingdom of Saudi Arabia.

Risk Management

There are various measured risks including schedule risks, scope risks, budget risks, personal risks, technical risks and quality risks. The project mostly exposed to risks such as personnel, budget, technical and quality risks. The project correctly suffered from personal risks with not trained healthcare professionals or nor sufficient pharmacists and pharmacy technicians. The budget risk was not covered the education and training courses for all pharmacy staff and healthcare professionals. There is another of technical risk maybe exposed. The technical risk, which is limited to electronic recourses, or not friendly use computer system in pharmacy practice. The project maybe exposed to quality risks with not implemented pediatrics and neonates’ medications safety tools or non-trained personnel.

Closing of the Project

The standardized concentration of pediatrics and neonates’ miscellaneous medications at all healthcare organizations of governmental and private sectors are mandatory to prevent drug-related mistakes, lead to morbidity and mortality and avert an economic burden on pharmacy and healthcare systems, including the hospitals and primary healthcare centers services in Saudi Arabia. The project should endure at the intravenous admixture of pediatrics and neonates’ parenteral medications at each pharmacy unit and keep supervision through related committees. The standardized pediatrics and neonates’ concentration education and training should be implemented accordingly. Pediatrics and neonate’s miscellaneous medications concentration should inform regularly and expand the number of medications is recommended in the future. The annual celebration of all intravenous admixture pediatrics and neonates’ pharmacy staff, including pharmacists and pharmacy technicians is highly optional in Saudi Arabia.

ACKNOWLEDGEMENT

None.

CONFLICT OF INTEREST

None.

FUNDING

None.

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; SWOT: Strengths, Weaknesses, Opportunities and Threats; CNS: Central Nervous System; IV: Intravenous; BSC: Balance Scored Cards; IAC: intravenous admixture committee.

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