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

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ABSTRACT

Objectives: To discover the pediatrics and neonates standardized concentration of chemotherapy intravenous infusion as new initiatives in the Kingdom of Saudi Arabia.

Methods: It is a new initiative project drove by national standardized concentration of chemotherapy 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 consisted 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 chemotherapy intravenous infusion services with a defined vision, mission and goals. The services had various paybacks including clinical and economic on patients as discovered in the review. The continuous of the project was assured by risk management model description and the monitoring and controlling of the services as declared. The transition to operation project though closing project stage demonstrated in the analysis. Conclusion: The pediatrics and neonates standardized concentration of chemotherapy intravenous infusion services is a new initiative as part of the intravenous admixture program. The pediatrics and neonates standardized concentration of chemotherapy intravenous infusion will lessen medication errors and recover patient safety at healthcare system; it is highly recommended to implement in the Kingdom of Saudi Arabia.

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

INTRODUCTION

In 2012-2015, during the implementation of the medications safety program, the pediatrics pharmacy program was part of the plan at several hospitals in the Kingdom of Saudi Arabia. The pediatrics or neonatal pharmacy services contained of several programs and projects. The pediatrics medications safety program was part of the plan. The pharmacist did an excellent job during this period and declared the clinical and economic outcome of medication safety in pediatrics healthcare services. Furthermore, the pharmacist discovered the noteworthy role in total parenteral nutrition, intervention to reduce morbidity and avoid additional superfluous costs in the healthcare system. The pharmacist started standardized total parenteral nutrition in the pediatrics, neonates to prevent TPN related problems, and reduce healthcare providers and pharmacy staff workload. Several litterateurs’ showed mistakes with chemotherapy in pediatric patients, while local or the Middle East literature not existed. On the other hand, the standardized concentration of chemotherapy medications is a new initiative project as expandable of the role of the intravenous pharmacist in the medications safety program with pediatrics and neonatal populations. The aim of the project is to review pediatrics and neonatal standardized concentration of chemotherapy medications 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. The task force team of standardized chemotherapeutic concentration formulated and involved of from author’s expert in the parenteral medications. The committee utilized and drove the pharmacy parenteral administration guidelines and from the textbook and international literature standardized concentration of chemotherapeutic written by utilizing the international business model, pharmacy project guidelines and project management institution guidelines of a new project. The standardized concentration adjusted based on the 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

Each intravenous admixture services prepare a daily basis for various medications with...
different concentrations and multiple diluent solutions. Also, the nurses administer different medications with different concentrations and solution. A higher workload of parenteral admixture services had been done by pharmacy staff and received by patients through nursing care. The high workload of the various number of concentration and solution may lead to the preparation or administration mistakes. As a result, the standardized concentration and solution of demand to prevent medication errors and reduce the workload of healthcare providers. Moreover, it’s excellent opportunity to inspire pharmaceutical companies to manufacture the same and frequency fixed ready-made solutions.

Market Analysis

Several medications came as powers for reconstitution or ampoules for mixing with diluent solutions. Other medications came as ready-made solution or diluted with a solution ready for administration. The ready came as strength of medications regardless of the approbate concentration administration through a central venous or peripheral line. Also, the pharmacy services had a manual preparation of parenteral medications with various concentration and solution diluted in. Those multiple factors may progress to increase workload and medications mistake. As a result, the standardized concentration of intravenous medications might decrease the workload and advance medication safety in practice.

SWOT Analysis

The most popular method utilized in quality management called the SWOT Analysis, which stands for the strengths, weaknesses and opportunities elements. The project had several strong points; for instance, implemented medication safety prevention measures, the reductions of the pharmacy with healthcare workload reductions. On the other hand, the weak points, including a few medications concentration and a limited number of diluent solutions. Moreover, there are multiple points for the opportunity; for instant implementation of patient safety and accreditation standards processes, while the threat points are if the higher administration of the project or pharmacy plan changes in the future.

Project Description

The following policies were put in place for every pharmacist and other health care individuals:

✓ The pediatric and neonatal standardized chemotherapy concentration guidelines, should be formulated at healthcare organizations.
✓ The pediatric and neonatal standardized chemotherapy concentration committee should consist of pediatric, neonate’s IV pharmacist, pharmacy technician, pediatric oncology nursing representative, pediatric oncology surgical or medical representative, pediatrician physician, nurse representative, neonatal physician and nurse representative.
✓ The committee revises the pediatric and neonatal standardized chemotherapy concentration and informs at least annually.
✓ The education and training sessions should be conducted by the committee to all healthcare providers, including oncology physicians and nurses, with pediatrics and neonate’s pharmacy staff.
✓ The pediatric and neonatal standardized chemotherapy concentration distributed to healthcare sectors at the institutions (Table 1).
✓ The physician transcribes the prescription based on the pediatric and neonatal standardized chemotherapy concentration.
✓ If the physician wishes to prescribe outside the pediatric and neonatal standardized chemotherapy concentration guidelines, he should document the justification.

Plan Cost Management

The financial budget should be selected in every new project. Also, the budget comprehends several things included the cost of the administration team meeting, educational courses and updated references. However, the budget should be observed from time to time.

Executing Phase

Management Team

Each project had to have a leading administrative team. The team comprised of several essential memberships’ specialties. For an instant, a pediatric oncology clinical pharmacist, oncology distributive pharmacist, pharmacy technician, pharmacy total quality pharmacist, pediatrics medications safety pharmacist and pediatric oncology physician. The team had responsibilities for the implementation and monitoring of the project. The team had to educate and train concern healthcare providers about the project. The team update all standardized concentration medications list periodically and resolve any project problem-related issues until the project become one of operation system in healthcare organizations.

Education and Training

Any new project needs orientation for management team members, education, and training for pharmacy staff, including pharmacists, pharmacy technicians and the healthcare providers, including physicians and nurses. Regular orientation for the project
| No. | Medication            | Strength              | Solution   | Rate of infusion | Stability of solution | Final Preparation with Maximum Concentration | Final Preparation with Standard Concentration | Rate of Infusion | Ref   |
|-----|-----------------------|-----------------------|------------|------------------|-----------------------|---------------------------------------------|-----------------------------------------------|------------------|-------|
| 1   | Alemtuzumab           | 300 mg Vial           | NS, D5W    | 2-4 hrs          | 8 hr                  | 15 mg/50 ml NS                              | 15 mg/50 ml D5W                                | 2-4 hrs          |       |
| 2   | Arsenic               | 1 mg/ml 10 ml Injection | NS, D5W    | 24 hr            | 8 hr                  | 1 mg/ml                                     | 1 mg/ml                                       | 8 hr             |       |
| 3   | Asparaginase E.coli   | 10,000 IU Vial        | NS, D5W    | 30-60 min        | 30 min                | 500 IU/100 ml NS                            | 500 IU/100 ml D5W                              | 30-60 min        |       |
| 4   | Ascorbiate            | 100 mg NS             | NS         | 8 hr             | 8 hr                  | 25 mg/100 ml NS                             | 25 mg/100 ml D5W                              | 8 hr             |       |
| 5   | Bevacizumab           | 25 mg/ml 4 ml         | NS         | 8 hr             | 8 hr                  | 1 mg/ml                                     | 1 mg/ml                                       | 8 hr             |       |
| 6   | Bleomycin             | 15 IU/Naïl            | NS, D5W    | 24 hr            | 8 hr                  | 50 mg/100 ml NS                             | 50 mg/100 ml D5W                              | 24 hr            |       |
| 7   | Carmustine            | 100 mg NS             | NS, D5W    | 8 hr             | 8 hr                  | 50 mg/100 ml NS                             | 50 mg/100 ml D5W                              | 8 hr             |       |
| 8   | Cisplatin             | 50 mg NS              | NS         | 24 hrs           | 8 hr                  | 5 mg/250 ml NS                              | 5 mg/250 ml D5W                                | 24 hrs           |       |
| 9   | Cladribine            | 10 mg                 | NS         | 24 hrs           | 8 hr                  | 1 mg/ML                                     | 1 mg/ML                                       | 8 hr             |       |
| 10  | Clofarabine           | 20 mg/20 ml Infusion  | NS, D5W    | 24 hrs           | 8 hr                  | 0.5 mg/ML                                   | 0.5 mg/ML                                     | 8 hr             |       |
### Table 1: Suggested Pediatrics and Neonates Standardized Chemotherapy Medication

| ID | Medication       | Concentration | Route | Volume | Concentration/mL | Volume/mL | Administration | Storage | Duration |
|----|------------------|---------------|-------|--------|------------------|------------|----------------|----------|----------|
| 12 | Cyclophosphamide | 100 mg        | NS, D5W | 25 ml SWFI or NS for each 500 mg | 50 mg/25 ml NS | 200 mg/100 ml NS | 500 mg/250 ml NS | 20 mg/mL | 50 mg/15 ml NS | 200 mg/50 ml NS | 500 mg/100 ml NS | 24 hrs | 6 days NS 36 hrs D5W | 1-6 hrs |
| 13 | Cytarabine       | 100 mg        | NS, D5W | NA     | NA               | NA        | NA             | 50 mg/500 ml NS | 100 mg/500 ml NS | 500 mg/500 ml NS | 1000 mg/500 ml NS | 2000 mg/500 ml NS | 500 mg/250 ml D5W | 1000 mg/500 ml D5W | 1000 mg/500 ml D5W | NA       | 50 mg/500 ml D5W | 100 mg/500 ml D5W | 200 mg/500 ml D5W | 1000 mg/500 ml D5W | 8 days | NA | 1-3 hrs |
| 14 | Daunorubicin     | 20 mg         | NS, D5W | 4 ml   | NA               | 20 mg/50 ml NS | 40 mg/50 ml NS | 20 mg/50 ml D5W | 20 mg/25 ml D5W | 20 mg/25 ml D5W | 24 hrs | 48 hrs | 60 min |
| 15 | Docetaxel        | 20 mg/ml      | NS, D5W | NA     | 0.3 mg/mL        | 20 mg/50 ml NS | 20 mg/25 ml D5W | 50 mg/50 ml NS | 20 mg/25 ml D5W | 20 mg/25 ml D5W | 0.74 mg/mL | 20 mg/100 ml NS | 50 mg/100 ml NS | 20 mg/100 ml D5W | 20 mg/100 ml D5W | 6 hrs | 48 hrs | 60 min |
| 16 | Doxorubicin      | 10 mg         | NS, D5W | 5 ml NS for 10 mg, and 25 ml for 50 mg vial | 10 mg/100 ml NS | 15 mg/100 ml NS | 20 mg/100 ml NS | 30 mg/100 ml NS | 10 mg/100 ml D5W | 15 mg/100 ml D5W | 30 mg/100 ml D5W | 50 mg/100 ml D5W | 10 mg/50 ml D5W | 15 mg/50 ml D5W | 30 mg/50 ml D5W | 50 mg/50 ml D5W | NA | NA | 15-60 min |
| Table 1: Suggested Pediatrics and Neonates Standardized chemotherapy medication (12-13,23-36) |
|---|---|---|---|---|---|---|---|---|---|
| 17 | Etoposide | 100 mg/5ml | NS, D5W | NA | 0.2 mg/mL | 20 mg/50 ml NS | 30 mg/250 ml NS | 50 mg/500 ml NS | 24-96 hr | NA | 60 min |
| 18 | Fludarabine | 50 mg Injection | NS, D5W | 2 ml SWFI | 0.25 mg/ml | 10 mg/50 ml NS | 15 mg/50 ml D5W | 10 mg/50 ml NS | 24 hrs | 24 hrs | 30 min |
| 19 | Fluorouracil | 50 mg/ml (5 ml/10 ml) Injection | NS, D5W | NA | 1 mg/mL | 250 mg/100 ml NS | 500 mg/100 ml NS | 250 mg/100 ml D5W | 14 days | 14 days | 23-24 hrs |
| 20 | Gemcitabine | 200 mg 1000 mg | NS | 5 ml NS for 200 mg, and 25 ml for 1000 mg vial | 0.1 mg/mL | 250 mg/250 ml NS | 500 mg/250 ml NS | 38 mg/mL | 24 hrs | NA | 30 min |
| 21 | Idarubicin | 1 mg/ml Injection | NS, D5W | 10 SWFI | 1 mg/mL | 5 mg/25 ml NS | 10 mg/25 ml D5W | NA | 5 mg/10 ml NS | 10 mg/10 ml D5W | 72 hrs | NA | 10-15 min |
| 22 | Ifosfamide | 1 gm | NS, D5W | 20 SWFI | 0.6 mg/mL | 500 mg/100 ml NS | 1000 mg/250 ml NS | 20 mg/mL | 500 mg/50 ml NS | 1000 mg/100 ml NS | NA | 24 hrs | 1-6 hrs |
| 23 | Irinotecan | 100 mg/5 ml Injection | D5W | NA | 0.12 mg/mL | 25 mg/250 ml D5W | 50 mg/250 ml D5W | 25 mg/250 ml D5W | 24 hrs | 48 hrs | 90 min |
| 24 | Leucovorin | 15 mg 50 mg | D5W | 1.5 ml SWFI for 15 mg | 0.1 mg/mL | 15 mg/25 ml D5W | 7.5 mg/25 ml D5W | 20 mg/mL | 15 mg/10 ml D5W | 7.5 mg/10 ml D5W | 24 hrs | 24 h | 15-120 min |
| 25 | Mesna | 400 mg | NS, D5W | NA | 0.5 mg/mL | 100 mg/100 ml NS | 200 mg/100 ml NS | 200 mg/100 ml D5W | 100 mg/100 ml NS | 200 mg/100 ml NS | 24 hrs | 48 hrs | 15 min-24 hr |
| 26 | Melphalan | 50 mg Injection | NS | 10 ml NS | 0.1 mg/mL | 25 mg/100 ml NS | 50 mg/500 ml NS | 100 mg/500 ml NS | 25 mg/100 ml NS | 50 mg/250 ml NS | 100 mg/250 ml NS | 4 hrs | NA | 15-20 min |
|   | Drug Name  | Dose | Solution | Volume | Concentration | Amount | Stability |  |
|---|------------|------|----------|--------|---------------|--------|-----------|---|
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 500mg | NS,D5W | 9.7 ml NS for 500 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
| 27 | Methotrexate | 50mg | NS,D5W | 0.97 ml NS for 50 mg | 25 mg/50 ml NS | 25 mg/ml | 7 days | 30 days | 24 hrs |
|   | Topotecan       | 34 | Vinblastine   | 35 | Vincristine   | 36 | Vinorelbine   | 37 |
|---|----------------|----|---------------|----|--------------|----|--------------|----|
|   | 4 mg/50 ml D5W |     | NS, D5W       | 1 mg | 1 mg | 50 mg/5 ml D5W |     |
|   | 1 mg/100 ml D5W |     | NS, D5W       | 10 mg | 1 mg | 50 mg/5 ml D5W |     |
|   | NA            |     | NS, D5W       | 1 mg  | 1 mg | 50 mg/5 ml D5W |     |
|   | 0.5 mg/25 ml D5W |     | NS, D5W       | 0.001 mg/ml | 0.03 mg/ml | 50 mg/5 ml D5W |     |
|   | 0.5 mg/50 ml NS |     | NS, D5W       | 0.08 mg/ml | 0.2 mg/ml | 50 mg/5 ml D5W |     |
|   | 0.5 mg/50 ml D5W |     | NS, D5W       | 0.1 mg/10 ml D5W | 0.3 mg/ml | 1 mg/5 ml D5W |     |
|   | 0.5 mg/50 ml NS |     | NS, D5W       | 0.1 mg/10 ml D5W | 0.3 mg/ml | 1 mg/5 ml D5W |     |
|   | 0.5 mg/50 ml NS |     | NS, D5W       | 0.1 mg/10 ml D5W | 0.3 mg/ml | 1 mg/5 ml D5W |     |
|   | 0.5 mg/100 ml D5W |    | NS, D5W       | 0.3 mg/ml | 1 mg/5 ml D5W |     |
|   | 0.5 mg/50 ml NS |     | NS, D5W       | 0.3 mg/ml | 1 mg/5 ml D5W |     |
|   | 0.5 mg/50 ml NS |     | NS, D5W       | 0.3 mg/ml | 1 mg/5 ml D5W |     |

**Abbreviations:** IVBP: Intravenous Piggyback, NA: Not Available, NS: Normal Saline, 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 appreciate the concentration of final preparations for any new healthcare or pharmacy staff joined the organization.

**Monitoring and Controlling Phase Project**

**Total Quality Management**

The Balance Scored Card is one of the total quantity management tools used for new project pediatrics and neonatal standardized concentration of chemotherapy medications.

BSC consisted of four types the customer, finance, internal process, education, and innovation. The declared example of internal processes was the assessment of healthcare services of patients and neonatal standardized concentration of chemotherapy medications. The type of education and innovation measured the clinical outcome of pediatrics and neonatal standardized concentration of chemotherapy medications and also explored the education and competency of pharmacy staff. Another example related to the financial type; the measurement of the economic impact of pediatrics and neonatal standardized concentration of chemotherapy medications, while the customer types may be measure the patients, pharmacy staff, healthcare professionals’ pediatrics and neonatal standardized concentration of chemotherapy medications gratification in Saudi Arabia.

**Risk Management**

There are six types of risk management, for instance, the budget risks, scope risks, schedule risks, personal risks, technical risks and quality risks. The project might have exposed to typical risks such as personnel, budget, technical and quality risks. The current project suffered from personal risks related to the shortage of pharmacists or pharmacy technicians or not trained pharmacy staff. The second risk might be exposed to a financial budget risk, for example, the budget is not adequately covered the education and training and also not applicable to updated references. Also, it does not implement the computerized system during prescribing or alerting as it is another type of technical risk of the current project. The pediatrics and neonatal standardized chemotherapy concentration may be exposed to quality risks including of not fully implemented medication safety or non-quality pharmacist in the total management specialty.
Closing of the Project
The pediatrics and neonatal standardized concentration of chemotherapy at all healthcare governmental and private organizations is highly suggested 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 repeatedly, update drug concentration and expanded parental medications necessary in the future. The annual celebration of all pediatrics and neonatal pharmacist and pharmacy technician staff is highly optional in the Kingdom of Saudi Arabia.

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

ABBREVIATIONS
MOH: Ministry of Health; KSA: Kingdom of Saudi Arabia; TPN: Total Parenteral Nutrition; SWOT: Strengths, Weaknesses, Opportunities and Threats; IV: Intravenous; BSC: Balance Scored Cards; IAC: intravenous admixture committee.

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