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

Yousef Ahmed Alomi^{*} , BSc. Pharm, MSc. Clin Pharm, BCPS, BCNSP, DiBA, CDE, Critical Care Clinical Pharmacists, TPN Clinical Pharmacist, Freelancer Business Planner, Content Editor and Data Analyst, Riyadh, Saudi Arabia.

Faiz Abdullah. Bahadig, R.Ph, Informatics Pharmacist, Pharmaceutical Care Department, King Abdul-Aziz Medical, City-WR-Jeddah, Ministry of National Guard, Saudi Arabia.

Hani Alhamdan, BSc. Pharm, MSc. Pharm, MBA, Director, Pharmaceutical Care services Department at KAMC-Jeddah, Ministry of National Guard, Saudi Arabia.

Correspondence:

Dr. Yousef Ahmed Alomi, BSc. Pharm, msc. Clin pharm, bcps, bcNSP, DiBA, CDE Critical Care Clinical Pharmacists, TPN Clinical Pharmacist, Freelancer Business Planner, Content Editor and Data Analyst, P.O.BOX 100, Riyadh 11392, Riyadh, SAUDI ARABIA.

Phone no: +966 504417712

E-mail: yalomi@gmail.com

ABSTRACT

Objectives: To explore the adult standardized concentration of chemotherapy agent 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 agent 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 adult standardized concentration of chemotherapy medications intravenous infusion services with a defined vision, mission and goals. The services had various benefits including clinical and economic on patients as explored in the review. The continuous of the project assured by risk management model description. In addition, the monitoring and controlling of the services as declared. The transition to operation project though closing project stage explored in the analysis. **Conclusion:** The adult standardized concentration of chemotherapy agent intravenous infusion services is a new initiative part of the intravenous admixture program. The standardized concentration of chemotherapy medications will reduce medication misadventures, decrease healthcare professional workload and avoid economic burden on healthcare system; it is highly recommended to implement in the Kingdom of Saudi Arabia.

Keywords: Adult, Standardized, Concentration, Chemotherapy, Medications, Intravenous, Saudi Arabia.

INTRODUCTION

The national medication safety program implemented several years back.^[1] The program consisted of multiple elements that are counting but not limited to medication safety assessment, the clinical outcome of medications safety and economic outcomes of medications safely.^[1] The medication's safety covered all medications with an emphasis on high alert medications with adults and patients' populations. The biohazard medications or chemotherapy therapy one of the high alert medications.^[2] The United States of Pharmacopeia released safety handling of cytotoxic medications and the American Society of Health system Pharmacist repeated they released the guidelines prevention of chemotherapy medication errors.^[3,4] Several factors were distressing the preparation of oncology medications to commit errors that are including but not limited to the following; a few workforces of pharmacy staff, high workload load and not unified guidelines of chemotherapy preparation.^[3,4] The American Society of Health-System Pharmacists (ASHP) stated initiatives about standardized concentration to prevent medication errors for all medications but not included chemotherapy.^[5,6] Several publications had been done about the standardized concentration of medication except chemotherapy and the outcome of the standardized concentration services.^[7-12] The author, based on the best of their knowledge

was not familiar with any initiative project of standardized concentration of chemotherapy. The aim of the study is to review the 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.^[13] The task force team of standardized chemotherapeutic concentration formulated and contained of from the author's expert in the parenteral medications. The committee focused and drove the pharmacy parenteral administration guidelines and from the textbook and international litterateur Standardized concentration of chemotherapeutic written by utilizing the international business model, pharmacy project guidelines project management institution guidelines of a new project.^[14-17] The standardized concentration familiar 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 and the monitoring and controlling phase.

Received: 18-09-2019;

Accepted: 30-11-2019

Copyright: © the author(s), publisher and licensee International Journal of Pharmacology and Clinical Sciences. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License

Access this article online

www.ijpcs.net

DOI:
10.5530/ijpcs.2020.9.7

Initiative Phase

Assessment Needs

Every day the pharmacist and pharmacy technician prepare several parenteral medications with different concentrations and multiple diluent solutions. Besides, various doses for adults, patients and neonatal for different indicators. At the same time, the physician writes various intravenous prescriptions with different doses and concentrations. Also, the nurses administer multiple medications with different concentrations and solutions to various patients.

All those factors might lead to an increase in workload for healthcare professionals and pharmacy staff and succeeding medication errors in prescribing or preparation or dispensing and administration. The standardized one to two concentrations with the specific solution will decrease the workload and medication errors at all stages of medication management.

SWOT Analysis

There is a new analysis of popular tools called the SWOT Analysis, which means the strengths, weaknesses and opportunities elements. The strengths points of the project are medication safety prevention elements, healthcare providers and pharmacy workload reductions. On the other hand, the weak points are limited elements number of diluent solution and medication concentration. Also, the opportunity points are the quality patient safety program implementation and elements of the accreditation procedures. Besides, the threat points are if the administration banner which is not obtainable and if the pharmacy strategic plan which does not happen.

Market Analysis

The intravenous admixture services found one-third of the Ministry of Health hospitals based on the last survey, while all non-MOH hospitals and some private hospitals had IV admixture services. All they had adult parenteral preparation manual. It contained medications, role of administration, range of concentration and maximum concentration. However, there is no fixed or standardized concentration for each preparation. Even if it happened, it would not cover all medications. The adult's total parenteral nutrition had been standardized. The cardiopulmonary resuscitation medication or electrolyte in the processes to standardized in the nearest future.

Planning Phase

Scope of the Project

The project covers all parenteral, intravenous chemotherapy with standardized fixed concentration with regular and maximum one. That is based on update therapeutic adults doing and frequently over 24 per each cycle. It is including the type of solution dissolve or reconstitution inside it.

Vision, Missions, Goals

The vision of the project is best adults' standardized concentration and stability of intravenous chemotherapy, while the message is to deliver adults a standardized concentration of intravenous chemotherapy with most stabilized solution. The aim of the project is to standardize the adult's concentration of chemotherapy, to prevent mistakes of adult concentration of chemotherapy, to decrease the workload chemotherapy preparation and to avoid any needless wastage cost of intravenous chemotherapy.

Project Description

The following policies were put in place for every pharmacist and other health care individuals:^[18,19]

- ✓ The adult standardized concentration of chemotherapy committee should be formulated at healthcare organizations.
- ✓ The adult standardized concentration of chemotherapy committee should consist of oncology IV pharmacist and pharmacy technician, adult's oncology nursing representative and adult oncology surgical or medical representative and oncology pediatrics physician and nurse representative.
- ✓ The committee revises the Adult standardized concentration of chemotherapy and updates at least annually.
- ✓ The education and training sessions should be conducted by the committee to all healthcare providers, including physicians and nurses, with pharmacy staff.
- ✓ The adult standardized concentration of chemotherapy distributed to healthcare sectors at the institutions.
- ✓ The physician writes the prescription based on the adult standardized concentration of chemotherapy.
- ✓ If the physician wishes to prescribe outside the adult standardized concentration of chemotherapy guidelines, he should document the justification.
- ✓ The prescription should send to the pharmacy and oncology IV pharmacist

and pharmacy technician will prepare it based on the standardized concentration of medications.

- ✓ The pharmacy staff sends the medications to the oncology nursing department and the nurse administers the medications based on the adult standardized concentration of chemotherapy guidelines.
- ✓ The pharmacy department should measure the clinical outcome of the adult standardized concentration of chemotherapy
- ✓ The pharmacy department should measure the economic outcome of the adult standardized concentration of chemotherapy
- ✓ The pharmacy department should document any prescription non-adherence to adult standardized concentration of chemotherapy

Plan Cost Management

Each new project, the management team should recognize the financial budget, which comprises the cost of educational courses, the cost of the management team meeting and the cost of updated references. The budget should be observed throughout the project.

Executing Phase

Management Team

The project should establish by task force contained of oncology clinical pharmacist, oncology distributive pharmacist, oncology pharmacy technician, pharmacy total quality management, medical oncology physician and surgical oncology physician. The team should implement the follow the project. The clinical and economical in the healthcare system should be determined with regular update apprising of adult's standardized parental oncology medications. The team should appeal from pharmaceutical companies to replace oncology preparation by the readymade fixed concentration of chemotherapy and supportive therapy.

Education and Training

The new project wants education and training for pharmacy staff, including pharmacists and pharmacy technicians, about the project, preparation and dispensing of medications. Besides, education and training for healthcare providers, including physicians and nurses, about the project and prescribing and administration of medications, respectively. The team management member should have an orientation about the project and any

Table 1: Suggested Adults standardized of intravenous infusion chemotherapy medications.[23-35]

No.	Medication	Strength	Solution	Reconstitution Volume	Standard Concentration	Final Preparation with Standard Concentration	Maximum Concentration	Final Preparation With Maximum Concentration	Stability of premixed solution		Rate of infusion
									RT	Ref	
1	Alemtuzumab	300 mg Vial	NS, D5W	NA	NA	3mg/100 ml NS	0. 3mg/mL	3mg/100 ml NS	8 hr	8 hr	2-4 hrs
						10mg/100 ml NS		10mg/100 ml NS			
						15mg/100 ml NS		15mg/100 ml NS			
						30mg/100 ml NS		30mg/100 ml NS			
						3mg/100 ml D5W		3mg/100 ml D5W			
						10mg/100 ml D5W		10mg/100 ml D5W			
						15mg/100 ml D5W		15mg/100 ml D5W			
						30mg/100 ml D5W		30mg/100 ml D5W			
2	Arsenic Trioxide	1 mg/ ml 10ml Injection	NS, D5W	NA	NA	10mg/250 ml NS 10mg/250 ml D5W	NA	10mg/100 ml NS 10mg/100 ml D5W	24 hr	48 hr	2-4 hr
3	Asparaginase E.coli	10,000 IU/vial	NS, D5W	SWFI 4ml	NA	10,000 IU/100 ml NS 15,000 IU/100 ml NS	NA	10,000 IU/50 ml NS 15,000 IU/50 ml NS	NA	NA	30-60 mint
						10,000 IU /100 ml D5W		10,000 IU /50 ml D5W			
						15,000 IU /100 ml D5W		15,000 IU /50 ml D5W			
4	Azacitidine	100 mg	NS	SWFI 10ml	NA	25mg/100 ml NS 50mg/100 ml NS 100mg/100 ml NS	NA	25mg/50 ml NS 50mg/50 ml NS 100mg/50 ml NS	Prepare immediately before each dose	NA	10-40 mint
5	Bendamustine	25, 100 mg Injection	NS, D5W	SWFI 20ml	0.2mg/mL	25mg/100 ml NS 50mg/250 ml NS 100mg/500 ml NS 200mg/500 ml NS	0.6 mg/mL	25mg/50 ml NS 50mg/100 ml NS 100mg/500 ml NS 200mg/500 ml NS	3 hrs	24 hrs	30-60 mint
						25mg/100 ml D5W 50mg/250 ml D5W 100mg/500 ml D5W 20mg/500 ml D5W		25mg/50 ml D5W 50mg/100 ml D5W 100mg/500 ml D5W 20mg/500 ml D5W			
6	Bevacizumab	25mg/ ml 4	NS	SWFI 4ml	NA	75mg/100 ml NS 150mg/100 ml NS 350mg/100 ml NS 700mg/100 ml NS	NA	75mg/100 ml NS 150mg/100 ml NS 350mg/100 ml NS 700mg/100 ml NS	NA	8 hrs	60-90 mint
7	Bleomycin	15 IU / Vail	NS	5-10 ml NS	NA	15mg/10 ml NS 30mg/20 ml NS	3 units/ml	15mg/5 ml NS 30mg/10 ml NS	24 hrs	NA	10 mint

Table 1: Suggested Adults standardized of intravenous infusion chemotherapy medications.[23-35]

8	Cabazitaxel	60 mg/ 1.5 ml Vial	NS, D5W	5.67 ml	0.1 mg/ml	20mg/250 ml NS 40mg/500 ml NS	0.26 mg/ml	20mg/100 ml NS 40mg/250 ml NS	8 hr	24 hr	60 mint
9	Carboplatin	150 mg 450 mg	NS, D5W	NA	0.5 mg/ mL	150mg/250 ml NS 450mg/250 ml NS	NA	50mg/100 ml NS 450mg/100 ml NS	8 hr	NA	15-60 mint
10	Carmustine	100 mg	NS, D5W	27 ml SWFI	0.2 mg/mL	50mg/250 ml NS 100mg/250 ml NS 200mg/500 ml NS	1 mg/mL	50mg/100 ml NS 100mg/250 ml NS 200mg/250 ml NS	8 hr	24 hr	at least 2 hrs Do not exceed a rate of 1.66mg/ m2/mint
11	Cetuximab	100 mg	Not required	NA	2mg/mL	100mg/50 ml 200mg/100 ml	NA	100mg/50 ml 200mg/100 ml	8 hr	12 hr	Loading: 2 hrs Main.: 1hr
12	Cisplatin	50 mg	NS	50 ml SWFI	0.05/mL	25mg/500 ml NS 50mg/1000 ml NS 100mg/2000 ml NS	0.5 mg/mL	25mg/250 ml NS 50mg/500 ml NS 100mg/1000 ml NS	24 hrs	Don't Ref	6-8 hrs
13	Cladribine	10	NS	NA	NA	5mg/500 ml NS 10mg/500 ml NS	NA	5mg/250 ml NS 10mg/250 ml NS	8 hr	24 hr	2-24 hrs
14	Clofarabine	20 mg/20ml	NS, D5W	NA	0.15mg/ml	20mg/100 ml NS 40mg/250 ml NS	0.4mg/ml	20mg/50 ml NS 40mg/100 ml NS	NA	24 hrs	2 hrs
15	Cyclophosphamide	100 mg 200 mg 500 mg	NS, D5W	25ml SWFI or NS for each 500 mg	2mg/mL	100mg/50 ml NS 200mg/100 ml NS 500mg/250 ml NS 1000mg/500 ml NS	20 mg/mL	100mg/25 ml NS 200mg/50 ml NS 500mg/100 ml NS 1000mg/250 ml NS	24hrs	6 days NS 36 hrs D5W	1-6 hrs

Table 1: Suggested Adults standardized of intravenous infusion chemotherapy medications.[23-35]

16	Cytarabine	100 mg 500 mg 1000mg 2000mg	NS, D5W	NA	NA	100mg/500 ml NS 500mg/500 ml NS 1000mg/500 ml NS 2000mg/500 ml NS 100mg/500 ml D5W 500mg/500 ml D5W 1000mg/500 ml D5W 2000mg/500 ml D5W	NA	100mg/250 ml NS 500mg/250 ml NS 1000mg/250 ml NS 2000mg/250 ml NS 100mg/250 ml D5W 500mg/250 ml D5W 1000mg/250 ml D5W 2000mg/250 ml D5W	8 days	NA	1-3 hrs
17	Dacarbazine	100 mg/ vial	NS, D5W	9.9 ml SWFI	NA	100mg/250ml NS 200mg/250ml NS 300mg/250ml NS 100mg/250ml D5W 200mg/250ml D5W 300mg/250ml D5W	NA	100mg/100ml NS 200mg/100ml NS 300mg/100ml NS 100mg/100ml D5W 200mg/100ml D5W 300mg/100ml D5W	8 hrs	24 hrs	15-60 mint
18	Daunorubicin	20 mg	NS, D5W	4 ml SWFI	NA	40mg/50 ml NS 80mg/50 ml NS 40mg/50 ml D5W 80mg/50 ml D5W	NA	40mg/25 ml NS 80mg/25 ml NS 40mg/25 ml D5W 80mg/25 ml D5W	24 hrs	48 hrs	15-30 mint
19	Docetaxel	20 mg/ ml (1mL, 4mL vials) 80 mg Injection	NS, D5W	NA	0.3mg/mL	100mg/500 ml NS 200mg/500 ml NS 100mg/500 ml D5W 200mg/500 ml D5W	0.74mg/mL	100mg/250 ml NS 200mg/500 ml NS 100mg/250 ml D5W 200mg/500 ml D5W	6 hrs	48 hrs	60 mint
20	Doxorubicin (Liposomal)	2mg/ ml,10ml	D5W	NA	NA	20mg/250 ml D5W 40mg/250 ml D5W 50mg/250 ml D5W	NA	20mg/250 ml D5W 40mg/250 ml D5W 50mg/250 ml D5W	NA	24 hrs	60 mint
21	Doxorubicin	10 mg 50 mg	NS, D5W	5 ml NS for 10 mg, and 25 ml for 50 mg vial	NA	25mg/100 ml NS 50mg/100 ml NS 100mg/250 ml NS 25mg/100 ml D5W 50mg/100 ml D5W 100mg/250 ml D5W	NA	25mg/50 ml NS 25mg/50 ml NS 100mg/250 ml NS 250mg/50 ml D5W 50mg/100 ml D5W 100mg/250 ml D5W	NA	NA	15-60 mint

Table 1: Suggested Adults standardized of intravenous infusion chemotherapy medications.[23-35]

22	Etoposide	100 mg/5ml	NS, D5W	NA	0.2 mg/mL	50mg/500 ml NS 100mg/500 ml NS 200mg/1000 ml NS 50mg/500 ml D5W 100mg/500 ml D5W 200mg/1000 ml D5W	0.4 mg/mL	50mg/250 ml NS 100mg/250 ml NS 200mg/500 ml NS 50mg/250 ml D5W 100mg/250 ml D5W 200mg/1000 ml D5W	24-96 hr	NA	30-60 mint
23	Fludarabine	50 mg Injection	NS, D5W	2 ml SWFI	0.25mg/ml	50mg/250 ml NS 50mg/250 ml D5W	1mg/ml	50mg/100 ml NS 50mg/100 ml D5W	24hrs	24 hrs	30 mint
24	Fluorouracil	50 mg/mL (5 ml/10 ml) Injection	NS, D5W	NA	1mg/mL	250mg/100 ml NS 500mg/100 ml NS 1000mg/250 ml NS 250mg/100 ml D5W 500mg/100 ml D5W 1000mg/250 ml D5W	10mg/mL	250mg/50 ml NS 500mg/50 ml NS 1000mg/100 ml NS 250mg/50 ml D5W 500mg/50 ml D5W 1000mg/100 ml D5W	14 days	14 days	23-24 hrs
25	Gemcitabine	200mg 1000mg	NS	5 ml NS for 200 mg, and 25 ml for 1000 mg vial	0.1 mg/mL	500mg/250 ml NS 1000mg/250 ml NS 2000mg/250 ml NS	38mg/mL	500mg/100 ml NS 1000mg/100 ml NS 2000mg/100 ml NS	24 hrs	NA	30 mint
26	Idarubicin	1mg/ml Injection	NS,D5W	10 SWFI	1mg/ml	20 mg/50 ml NS 20 mg/50 ml D5W	NA	20 mg/25 ml NS 20 mg/25 ml D5W	72 hrs Protect from light	NA	10-15 mint
27	Ifosfamide	1 gm	NS, D5W	20 SWFI	0.6 mg/mL	1000mg /250 ml NS 2000mg /500 ml NS 1000mg /250 ml D5W 2000mg /500 ml D5W	20mg/mL	1000mg /100 ml NS 2000mg /250 ml NS 1000mg /100 ml D5W 2000mg /250 ml D5W	NA	24 hrs	1-6 hrs
28	Irinotecan	100 mg/5ml Injection	D5W	NA	0.12mg/mL	50 mg/500 ml D5W 100 mg/500 ml D5W 200 mg/500 ml D5W	2.8mg/mL	50 mg/250 ml D5W 100 mg/250 ml D5W 200 mg/250 ml D5W	24 hrs	48 hrs	90 mint
29	Leucovorin	50mg/ml	NS,D5W	5 ml SWFI	0.1mg/mL	15 mg/50 ml D5W 30 mg/50 ml D5W 50 mg/50 ml D5W	20mg/mL	15 mg/25 ml D5W 30 mg/20 ml D5W 50 mg/25 ml D5W	24 hrs	24 hrs	15-120 mint Maximum rate not exceed 160mg/min
30	Mesna	400 mg	N5, D5W	NA	0.5mg/mL	200 mg/100 ml NS 400 mg/100 ml NS 200 mg/100 ml D5W 400 mg/100 ml D5W	20mg/mL	200 mg/50 ml NS 400 mg/50 ml NS 200 mg/50 ml D5W 400 mg/50 ml D5W	24hrs	48 hrs	15min-24hr

Table 1: Suggested Adults standardized of intravenous infusion chemotherapy medications.[23-35]

31	Melphalan	50 mg Injection	NS	10 ml NS	NA	25 mg/100 ml NS 50 mg/500 ml NS 200 mg/1000 ml NS	0.45mg/ml	25 mg/100 ml NS 50 mg/250 ml NS 200 mg/500 ml NS	4 hrs	NA	15-20 min
32	Methotrexate	50mg 500mg	NS,D5W	0.97 ml NS for 50 mg 9.7 ml NS for 500 mg	NA	50 mg/50 ml NS 100 mg/100 ml NS 200 mg/100 ml NS 400 mg/100 ml NS 500 mg/100 ml NS 50 mg/50 ml D5W 100 mg/50 ml D5W 200 mg/50 ml D5W 400 mg/50 ml D5W 500 mg/50 ml D5W	25 mg/ml	50 mg/25 ml NS 100 mg/50 ml NS 200 mg/50 ml NS 400 mg/50 ml NS 500 mg/50 ml NS 50 mg/50 ml D5W 100 mg/50 ml D5W 200 mg/50 ml D5W 400 mg/50 ml D5W 500 mg/50 ml D5W	7 days	30 days	24 hrs
33	Mitoxantrone	20mg	NS,D5W	NA	NA	20 mg/100 ml NS 20 mg/100 ml D5W	NA	20 mg/50 ml NS 20 mg/50 ml D5W	7 days	7 days	5-30 mint
33	Nivolumab	100 mg/10ml 40 mg/4ml Injection	NS,D5W	NA	1mg/ml	100 mg/50 ml NS 200 mg/50 ml NS 250 mg/50 ml NS 100 mg/50 ml D5W 200 mg/50 ml D5W 250 mg/50 ml D5W	10mg/ml	100 mg/25 ml NS 200 mg/25 ml NS 250 mg/25 ml NS 100 mg/25 ml D5W 200 mg/25 ml D5W 250 mg/25 ml D5W	8 hrs	24 hrs	30 min
35	Oxaliplatin	50mg 100mg	D5W	10 ml SWFI OR D5W for 50 mg 20 ml for 100 mg	0.7 mg/ml	50 mg/500 ml D5W 100 mg/500 ml D5W 200 mg/500 ml D5W	NA	50 mg/250 ml D5W 100 mg/250 ml D5W 200 mg/250 ml D5W	6hrs	24 hrs	2-6 hrs
36	Paclitaxel (Conventional)	30mg 100mg 300mg	NS,D5W	NA	0.3mg/mL	30 mg/100 ml NS 100 mg/250 ml NS 300 mg/500 ml NS 30 mg/100 ml D5W 100 mg/250 ml D5W 300 mg/500 ml D5W	1.2mg/mL	30 mg/50 ml NS 100 mg/100 ml NS 300 mg/250 ml NS 30 mg/50 ml D5W 100 mg/100 ml D5W 300 mg/250 ml D5W	27 hrs	72hrs	3-24 hrs
37	Panitumumab	100 mg vial	NS	NA	NA	450 mg/250 ml NS	10mg/mL	450 mg/100 ml NS	6 hr	24 hr	60-90 mint

Table 1: Suggested Adults standardized of intravenous infusion chemotherapy medications.[23-35]

38	Pembrolizumab	100 mg/4ml Injection	NS,D5W	NA	1mg/mL	200 mg/250 ml NS 400 mg/250 ml NS 200 mg/250 ml D5W 400 mg/250 ml D5W	10mg/mL	200 mg/100 ml NS 400 mg/100 ml NS 200 mg/100 ml D5W 400 mg/100 ml D5W	6 hr	96 hr	30 mint
39	Pegaspargase	750 units/ml	NS,D5W	NA	NA	750 mg/100 ml NS 1500 mg/100 ml NS 2000 mg/100 ml NS 750 mg/100 ml D5W 1500 mg/100 ml D5W 2000 mg/100 ml D5W	NA	750 mg/100 ml NS 1500 mg/100 ml NS 2000 mg/100 ml NS 750 mg/100 ml D5W 1500 mg/100 ml D5W 2000 mg/100 ml D5W	Use immediately	24 hr	1-2 hrs
40	Pemetrexed	500mg	NS	20 ml NS	NA	500 mg/100 ml NS	NA	500 mg/50 ml NS	NA	24 hr	10 mint
41	Pertuzumab	420 mg/14ml Injection	NS	NA	NA	420 mg/250 ml NS 840 mg/250 ml NS	NA	420 mg/250 ml NS 840 mg/250 ml NS	Use immediately	24 hr	60 mint
42	Rituximab	100mg 500mg	NS,D5W	NA	1mg/mL	50 mg/50 ml NS 100 mg/100 ml NS 500 mg/500 ml NS 50 mg/50 ml D5W 100 mg/100 ml D5W 500 mg/500 ml D5W	4mg/mL	50 mg/25 ml NS 100 mg/50 ml NS 500 mg/250 ml NS 50 mg/25 ml D5W 100 mg/50 ml D5W 500 mg/250 ml D5W	24 hr	24 hr	50-400 mg/hr
43	Thiotepa	100 mg Vial	NS	10 ml of SWFI	0.5 mg/mL	250 mg/500 ml NS 500 mg/1000 ml NS	1 mg/mL	250 mg/250 ml NS 500 mg/500 ml NS	4 hrs	24 hrs	3 hrs
44	Topotecan	4 mg/4ml Injection	D5W, NS	NA	NA	2 mg/250 ml D5W 4 mg/250 ml D5W 2 mg/250 ml NS 4 mg/250 ml NS	NA	2 mg/100 ml D5W 4 mg/100 ml D5W 2 mg/100 ml NS 4 mg/100 ml NS	24 days	7 days	30 mint
45	Trastuzumab	150mg 440mg	NS	7.4 ml of SWFI for 150 mg, and 20 ml for 440 mg	NA	150 mg/250 ml NS 300 mg/250 ml NS	NA	150 mg/250 ml NS 300 mg/250 ml NS	24 hrs	24 hrs	90 mint
46	Vinblastine	1 mg 10 mg	NS,D5W	NA	NA	2 mg/50 ml NS 5 mg/50 ml NS 6 mg/50 ml NS 10 mg/50 ml NS 2 mg/50 ml D5W 5 mg/50 ml D5W 6 mg/50 ml D5W 10 mg/50 ml D5W	NA	2 mg/25 ml NS 5 mg/25 ml NS 6 mg/25 ml NS 10 mg/25 ml NS 2 mg/25 ml D5W 5 mg/25 ml D5W 6 mg/25 ml D5W 10 mg/25 ml D5W	5 days	7 days	15-30 mint

Table 1: Suggested Adults standardized of intravenous infusion chemotherapy medications.[23-35]

		1mg	NS, D5W	NA	0.0015mg/ml	2 mg/50 ml D5W 2 mg/50 ml D5W	0.08mg/ml	2 mg/25 ml NS 2 mg/25 ml D5W	21 days	21 days	5-10 mint Or 24 hrs
47	Vincristine										
48	Vinorelbine	50mg/5 ml	D5W, NS	NA	0.5 mg/mL	25 mg/50 ml D5W 50 mg/50 ml D5W	2mg/mL	25 mg/25 ml D5W 50 mg/5 ml D5W	24 hrs	24 hrs	6-30 mint 24 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 review the appropriate concentration of final preparations according to the strength of the medications, prescribing dose, and their local healthcare institution policy.

new pharmacy or healthcare staff join the institutions.

Monitoring and Controlling Phase Project Total Quality Management

The total quantity management during new project adults' standardized concentration of chemotherapy medications is one the vigorous tool to monitor the implementation and the project impact assessment. There are several total quality tools used with the current project and the balance scored cards was one of them. The tools monitor four-part that's including the customer, finance, internal process, education and innovation.^[20] An example of internal processes was the assessment of healthcare services of adult's standardized concentration of chemotherapy medications. In the education and innovation types, the procedures of clinical outcome of adults standardized concentration of chemotherapy medications, which could reflect the education and capability of pharmacists and pharmacy technicians. The financial type the measurement of the economic impact of adult's standardized concentration of chemotherapy medications. The customer types might measure the patients and healthcare providers, including the pharmacy staff of adults, standardized concentration of chemotherapy medications satisfaction in the Kingdom of Saudi Arabia.

Risk Management

The risk management had several types including budget risks, scope risks, schedule risks, personal risks, technical risks and quality risks.^[21,22] The project could be exposed to risks such as personnel, budget, technical and quality risks. The project may be had personal risks for an instant; there is not trained pharmacy staff or nor sufficient pharmacy. Another risk with the budget types, for example, shortage of pharmacy staff or not trained pharmacists and pharmacy technicians. Also, the budget risks might be exposed to the projects, for instance, if there is not enough budget for education and training or update resources. On the other hand, the technical risk may be exposed including there is a computerized system during prescribing. The new project might expose to quality risks related to non-available medications safety measures or shortage of total quality management pharmacists or pharmacy technicians.

Closing of the Project

The standardized concentration of adults chemotherapeutic at all healthcare hospitals and primary healthcare centers with different governmental and private sectors are highly

optional to prevent drug-related morbidity and mortality and avoid additional unnecessary cost on healthcare services in the Kingdom of Saudi Arabia. The project should continue at IV admixture at each pharmacy department with the engrossment of related committees. The Education and training of standardized adult concentration should be showed regularly. Update and parental medications for adult's standardized concentration are required in the future. The annual celebration of all pharmacist and pharmacy technician staff with encouraging them is highly recommended 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; **ASHP:** American Society of Health-System Pharmacists; **SWOT:** Strengths, Weaknesses, Opportunities and Threats; **IV:** Intravenous; **BSC:** Balance Scored Cards.

ORCID ID

Yousef Ahmed Alomi <https://orcid.org/0000-0003-1381-628X>

REFERENCES

1. Alomi YA. National medication safety program at ministry of health in Saudi Arabia. *J Pharmacovigil.* 2015;3(5):e145.
2. Institute for Safe Medication Practices. ISMP List of High-Alert Medications in Acute Care Settings. 2018. Available from: <https://www.ismp.org/sites/default/files/attachments/2018-08/highAlert2018-Acute-Final.pdf>.
3. United States Pharmacopeia. Hazardous Drugs-Handling in Healthcare Settings. The United States Pharmacopeial Convention. 2017;1-20.
4. Goldspiel B, Hoffman JM, Griffith NL, et al. ASHP guidelines on preventing medication errors with chemotherapy and biotherapy. *Am J Health Syst Pharm.* 2015;72(8):e6-35.

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;73(15):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. Lucas AT, Rowe E, Eckel SF. Determining the need for standardized infusions and concentrations at hospitals within North Carolina. Hosp Pharm. 2016;51(3):237-45.
9. Hilmas E, Sowon 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.
10. 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.
11. Nemecek 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.
12. Westerkamp T. Standardized concentrations for intravenous drip medications. Am J Hosp Pharm. 1988;45(9):1862.
13. Alomi YA. National Intravenous (IV) Therapy Program at MOH in Saudi Arabia. EC Pharm Sci. 2016;3(2-3):307-11.
14. McDonough R. Writing a business plan for a new pharmacy service. The Dynamics of Pharmaceutical Care: Enriching Patients Health. 2010;23.
15. 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.
16. Sachdev G. Sustainable business models: Systematic approach toward successful ambulatory care pharmacy practice. Am J Heal Pharm. 2014;71(16):1366-74.
17. PMBOK Guide. A guide to the project management body of knowledge. Sixth Edition. Project Management Institute Inc. 2017.
18. Mitchell A, Sommo P, Mocerine T, *et al.* A Standardized Approach to Pediatric Parenteral Medication Delivery. Hospital Pharmacy. 2004;39:433-59.
19. Sowon 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.
20. 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>.
21. Ray S. The risk management process in project management. Project Manager. 2017. Cited 2020 Mar 15. Available from: <https://www.projectmanager.com/blog/risk-management-process-steps>.
22. 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>.
23. Benizri F, Bonan B, Ferrio AL, *et al.* Stability of antineoplastic agents in use for home-based intravenous chemotherapy. Pharm World Sci. 2009;31(1):1-13.
24. Vigneron J, Astier A, Trittler R, *et al.* SFPO and ESOP recommendations for the practical stability of anticancer drugs: An update. Eur J Oncol Pharm. 2014;8(2):3-13.
25. Adams SC, Vyas HM, Anderson RW. Pharmaceutical issues in infusion chemotherapy stability and compatibility. In: Cancer Chemotherapy by Infusion. 1987;100-13.
26. Ministry of Health. Ministry of Health Formulary. Health Ministry of Health. 2012.
27. Saudi Food and Drug Authority. List of human medicine and herbal health [Internet]. [cited 2019 Jun 17]. Available from: <https://www.sfda.gov.sa/en/drug/resources/Pages/DrugsUnderRegistrations.aspx>
28. Baxter K, Aikman K, Luckhurst R, *et al.* British National Formulary 78 (BNF). Royal Pharmaceutical Society; 1-1701.
29. Alomi YA, *et al.* Adults Parenteral Dilution Manual. 2015. Available from: https://www.researchgate.net/publication/281710454_Adults_Parenteral_Dilution_Manual
30. Wolters Kluwer Clinical Drug Information. Inc. (Lexi-Drugs). Wolters Kluwer Clinical Drug Information, Inc.; 2020.
31. Drugs.com. Drugs.com, Prescription Drug Information, Interactions & Side Effects [Internet]. Drugs.com. 2020 [cited 2020 Jun 16]. Available from: <https://www.drugs.com/>
32. King Abdulaziz Medical City. Unified IV Manual. 2020.
33. Wolters Kluwer Clinical Drug Information. Inc. (ASHF Essentials adults and pediatrics). Wolters Kluwer Clinical Drug Information, Inc.; 2020.
34. Wolters Kluwer Clinical Drug Information. Inc. (Pediatrics & Neonatal Lexi-Drugs). Wolters Kluwer Clinical Drug Information, Inc.; 2020.
35. Wolters Kluwer Clinical Drug Information. Inc. (Nursing Lexi-Drug). Wolters Kluwer Clinical Drug Information, Inc.; 2020.