Clinical Pharmacy in Oncology

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TUMS

Introduction

- Pharmacists began training and defining their role in medical oncology practice in 1976.

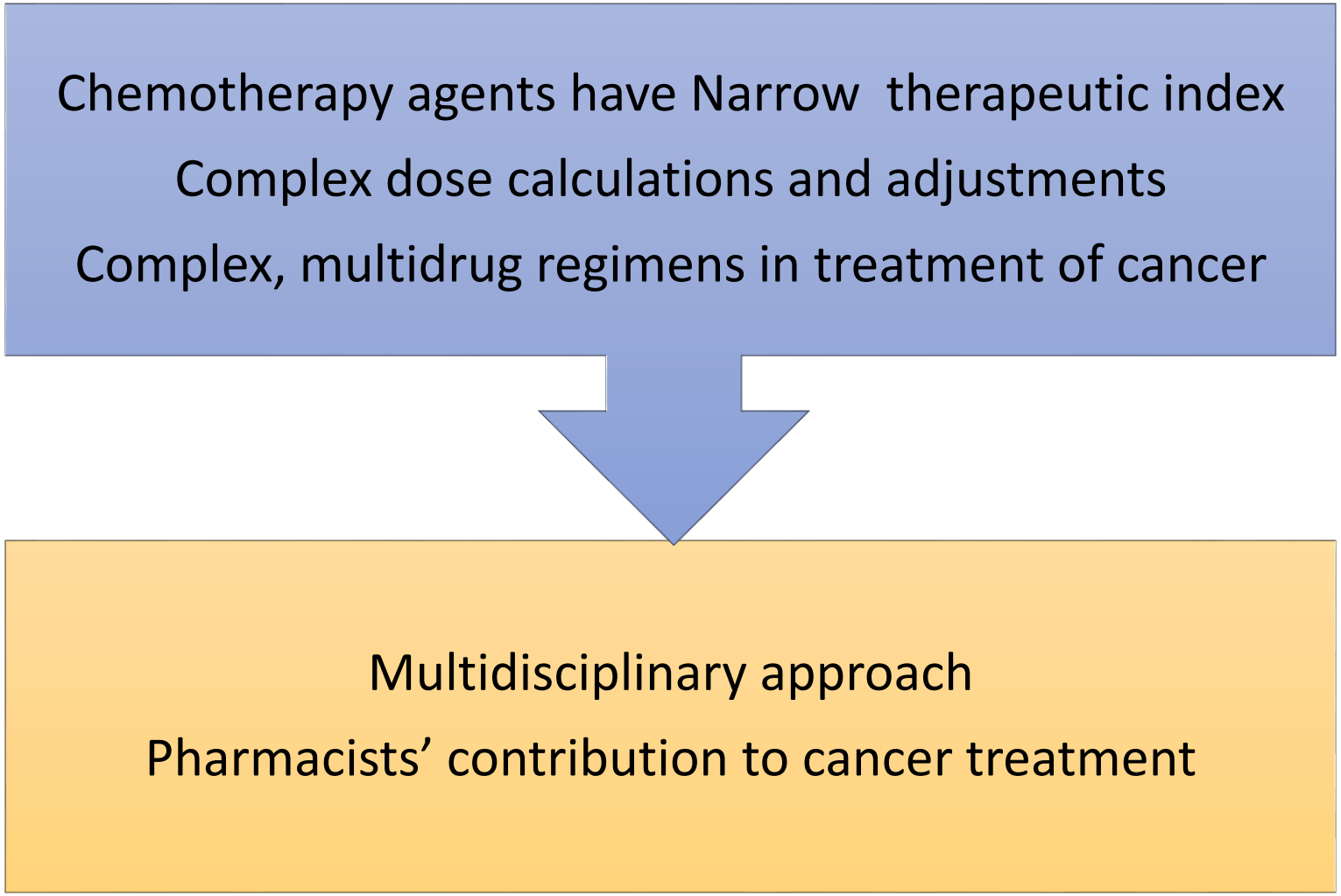
- A curriculum was drafted for pharmacy students at the University of Tennessee in the US to contribute them in the therapeutic care of cancer patients.

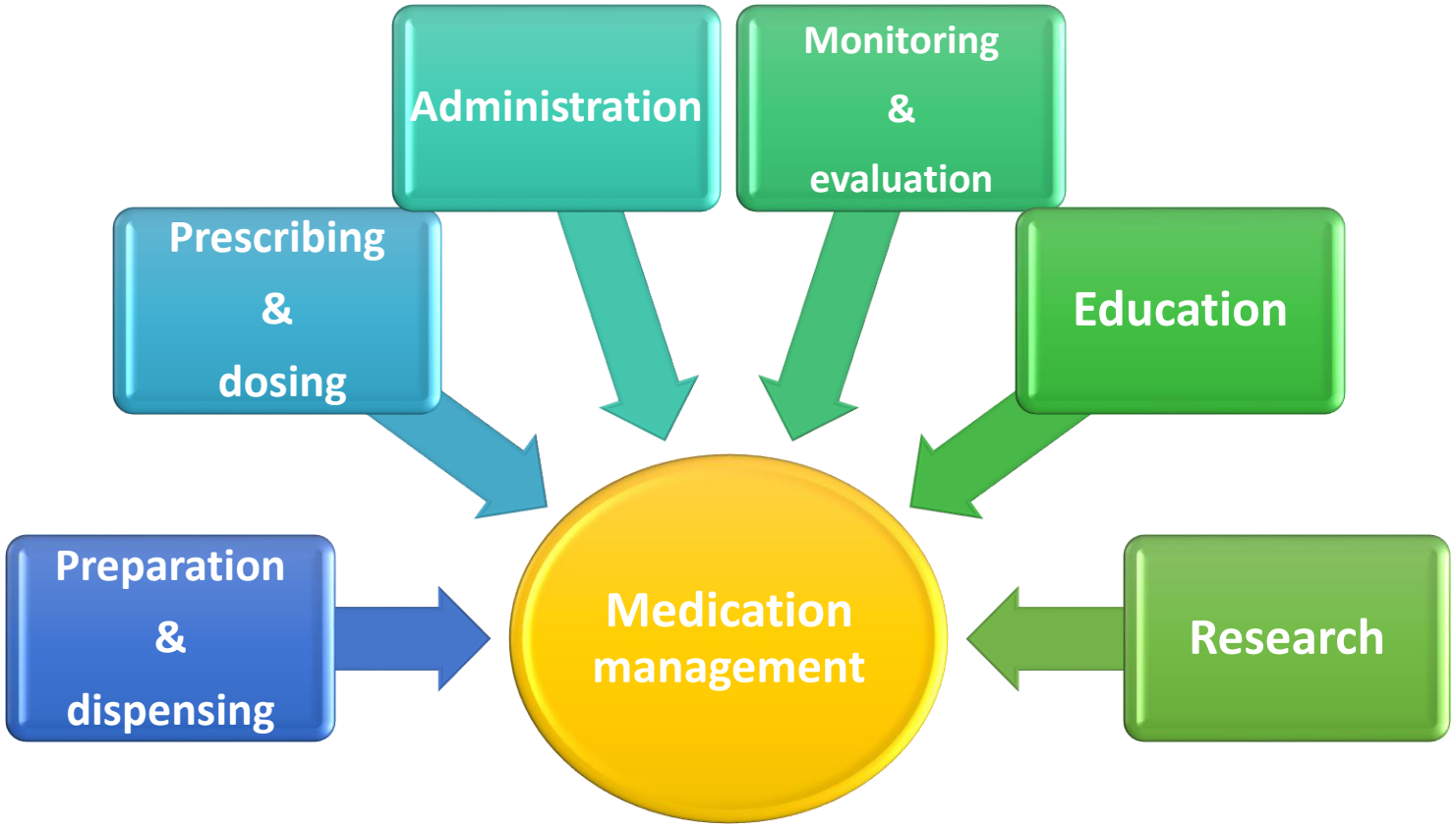
- The basis of the curriculum emphasized on pharmacokinetics of drugs ,extensive training in pharmacology and medicinal chemistry.

ASHP description of Pharmacist Role

- The American Society of Health-System Pharmacists (ASHP) published guidelines in 1990, 1993, 1996, and 2002 to describe pharmacist's role not only in safe handling, preparation, and dispensing of drugs but also in pharmaceutical care as the health professional.

Directly responsible for the provision outlined for medication-related care for the purpose of achieving definite outcomes that improve a patient's quality of life.
The pharmacist is deemed responsible for identifying, resolving, and preventing medication-related problems such as untreated indications, improper drug selection, inadequate dosing, adverse drug reactions, interactions and medication use without indication


Chemotherapy agents have Narrow therapeutic index
Complex dose calculations and adjustments
Complex, multidrug regimens in treatment of cancer
Multidisciplinary approach
Pharmacists' contribution to cancer treatment



Each of these processes helps to support optimal anticancer drug treatment

Prescribing, dosing, and transcribing

- Prescribing chemotherapy regimens is complicated, with dosing calculations based upon body surface area (BSA) and varying administration on consecutive and nonconsecutive days.
- Mistakes in prescriptions can lead to significant medication error.
- General medication errors in hospitals generally range from 2% to 5%.
- Chemotherapy error rates have been reported at 3%–16%.

Prescribing, dosing, and transcribing

- Errors in ordering are most common, followed by administration and then dispensing.

- Standard chemotherapy order forms created by OPSs have been shown to minimize errors

- Betsy Lehman, Boston Globe Health Reporter

- A medication error that occurred in 1994 at the Dana-Farber Cancer Institute in Boston, MA, USA, when a dose written for cyclophosphamide 4 g/m^2 to be given over 4 days was instead given daily for 4 consecutive days

بسمه تعالی

مجتمع بیمارستانی امام خمینی(ره)

برگ دستورات شیمی درمانی پزشک

PHYSICAN'S CHEMOTHERAPY ORDER SHEET

دانشگاه علوم پزشکی و خدمات بهداشتی درمانی تهران

شماره پرونده: Unit No:		کد ملی: National ID.No.			
نام خانوادگی: Family Name:	نام: Name:	بخش: Ward:	پزشک معالج: Attending Physician:		
نام پدر: Father Name:	تاریخ تولد: Date of Birth:	اتاق: Room:	تاریخ پذیرش: Date of Admission:		
		تخت: Bed:			

تاریخ Date	ساعت Time	رژیم:	دوره:	BSA:	مهر و امضاء پزشک Signature of Physician	مهر و امضاء پرستار Signature of Nurses
		تشخیص:	وزن:	قد:		

روز تزریق دارو	زمان انفوزیون	حجم حلال(ml)	نوع حلال	راه تجویز	دوز محاسبه شده(mg/d)	درصد تعدیل	دوز دارو($mg/m^2/d$)	نام دارو

Standard chemotherapy order forms

- Diagnosis
- Height
- Most recent weight
- BSA calculation
- Dosage (mg/m^2)
- Final calculated dose
- Start date and time
- Day of therapy
- Solution diluent and volume
- Infusion rate (drips)
- Route (intravenous [IV] push or infusion)
- Duration of infusion
- Frequency of administration
- Total number of scheduled doses

Prescribing, dosing, and transcribing

- Pharmacists contribute significantly to the dosing portion of the prescribing process.
  - Chemotherapy dosing in elderly patients
  - Chemotherapy dosing for both the underweight and overweight patient
  - Dosing in presence of drug–drug interactions

Medication review

- Medication reconciliation (admission, hospitalization, discharge):
  - Anticancer treatment
  - Supportive care
  - Ambulatory treatment
  - Self medication
- Medication problems
  - Inappropriate medications
  - Inappropriate dosing and mode of administration
  - Drug–drug interactions
  - Drug omissions
  - Lack of monitoring

In a population of 212 adult hospitalized cancer patients in France (2,572 prescriptions including chemotherapy and support), the integration of clinical pharmacy services resulted after medication review in drug-specific interventions for 10% of the prescriptions.

- 20% of the interventions concerned inappropriate medications.
- Drug–drug interactions were reported in 10% of the interventions (representing 1% of the prescriptions).
- Most of the interventions concerned anti-infective agents
- The intervention acceptance rate by oncologists was high (97%).

- A Dutch study reported a higher rate of medication problems (20%) in a population of 546 patients receiving anticancer treatment.
    - Drug problems mainly concerned contraindications and drug–drug interactions.

Drug- Drug interactions

- Pharmacokinetic drug interactions in metabolism:
  - Taxanes , Vinca alkaloids, Anthracyclines
  - Etoposide, Irinotecan, Cyclophosphamide
- High dose MTX (≥500 mg/m^2)
  - PPIs
  - Co-trimoxazol
  - NSAIDs

  ↑ MTX level
- Pemetrexed
  - NSAIDs ↑ Pemetrexed concentration

Drug- Drug interactions

- Capecitabine
  - Warfarin
    - Clinically significant increases in PT and INR
  - PPIs
    - ↑ pH levels may inhibit dissolution and absorption of capecitabine
  - Allopurinol
    - Decrease serum concentrations of the active metabolite(s) of Capecitabine

- Bortezomib
  - Vitamin C
  - Green Tea

} May diminish the therapeutic effect of bortezomib

Oral agent interactions

- Tamoxifen
  - SSRIs
  - decreased tamoxifen efficacy
  - Strong CYP2D6 inhibitors (eg, fluoxetine, paroxetine) and moderate CYP2D6 inhibitors (eg, sertraline)
- Enzalutamide
  - Is a strong CYP3A4 inducer
- Abiratrone acetate
  - Overexposure also occurs (ten-fold) is taken with food

Tyrosine -kinase inhibitors interactions

- Acid suppressive drugs (PPIs, H_2 antagonists, and antacids)
  - Crizotinib, Dasatinib, Erlotinib, Gefitinib, Lapatinib And Pazopanib
  - If possible, the combination should be avoided, or the time of drug intake should be separated by several hours at least
- Strong CYP3A4 inhibitors and strong CYP3A4 inducers
  - Axitinib, Crizotinib, Dasatinib, Erlotinib, Gefitinib, Imatinib, Lapatinib, Nilotinib, Pazopanib, Regorafenib, Ruxolitinib, Sunitinib, Vemurafenib
  - Dose adjustments or avoidance are highly recommended

Tyrosine -kinase inhibitors interactions

- QTc-interval-prolonging drugs
  - Crizotinib, Gefitinib, Lapatinib, Nilotinib, Pazopanib, Sorafenib, Sunitinib, Vandetanib, Vemurafenib
  - An ECG should be obtained 24–48 h before and 1 week after initiating the concomitant therapy

To improve the safe use of tyrosine-kinase inhibitors in clinical oncology, a profound assessment of co-prescribed drugs, herbal supplements, lifestyle food and drinks (eg, grapefruit juice) is needed

Preparation and dispensing

- Many cytotoxic drugs have been found to be
  - Mutagenic
  - Teratogenic
  - Carcinogenic
- Health workers preparing cytotoxic drugs without adequate precautions have been shown to contaminate themselves and their work environment.
- Reports of increased fetal loss and birth abnormalities in nurses, as well as anecdotal reports of other toxicities have been published.
- Potential risk was deemed serious enough to warrant the issuing of several drug-handling guidelines during the 1980s and 1990s

NIOSH List of Antineoplastic and Other Hazardous Drugs in Healthcare Settings, 2016

Tamoxifen

Valganciclovir

Chloramphenicol

Estrogens, conjugated

Azathioprine

Ganciclovir

Cyclosporine

CDC Workplace Safety and Health

NIOSH

Preparation and dispensing

- Policies and procedure establishment
- Compounding area compliance with regulatory standards
- Standardized charts and drug information for preparation
- Personal Protective Equipment
- Appropriate Supplies & Devices
- Trained personnel

2012

USP 35
NF 30

USP–NF General Chapter <797>

Pharmaceutical Compounding—
Sterile Preparations

2017

USP General Chapter <800>
Hazardous Drugs –
Handling in Healthcare Settings

Reprinted from USP 40—NF 35, Second Supplement (2017)

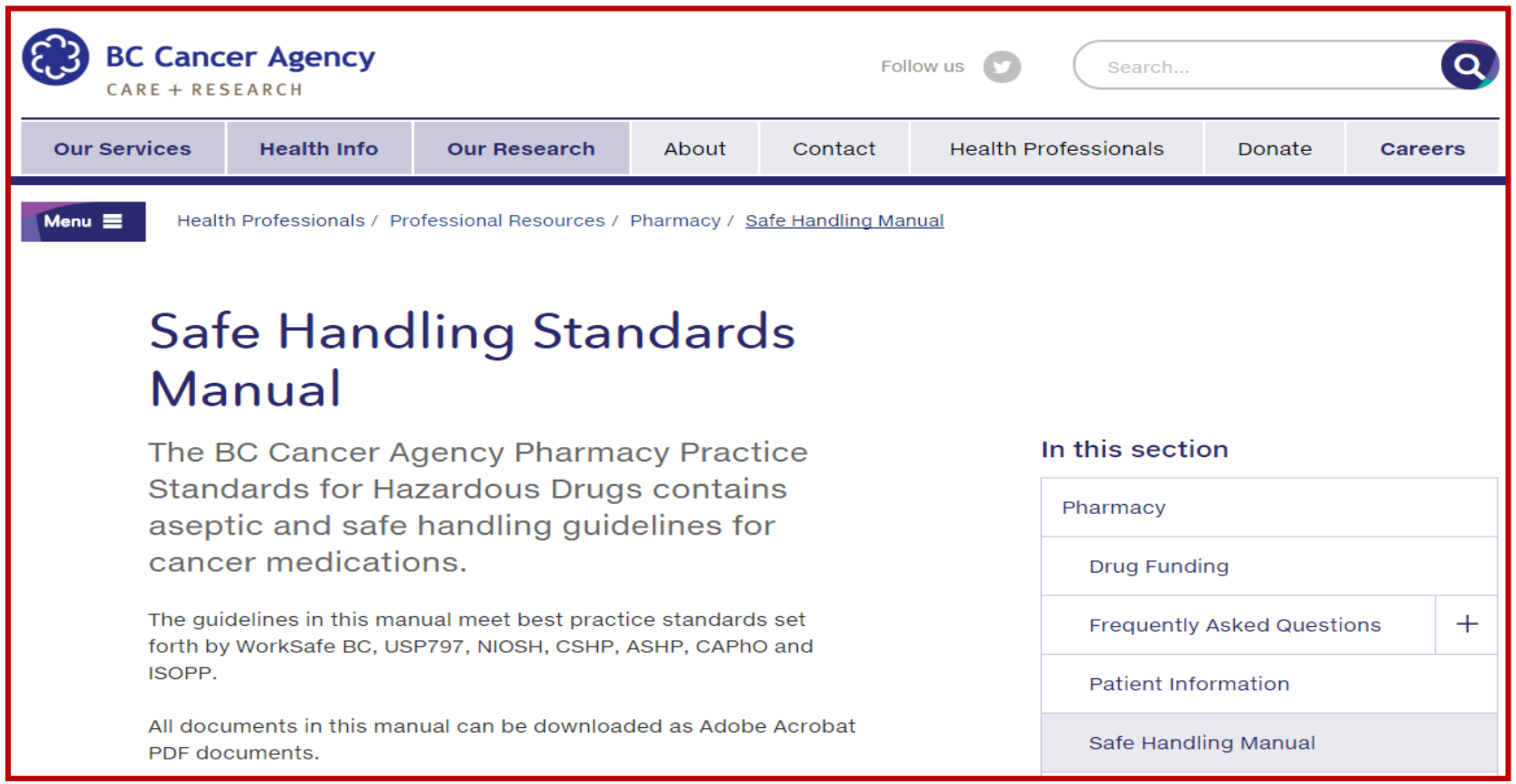
ASHP Guidelines on Handling Hazardous Drugs

Cancer Care Nova Scotia

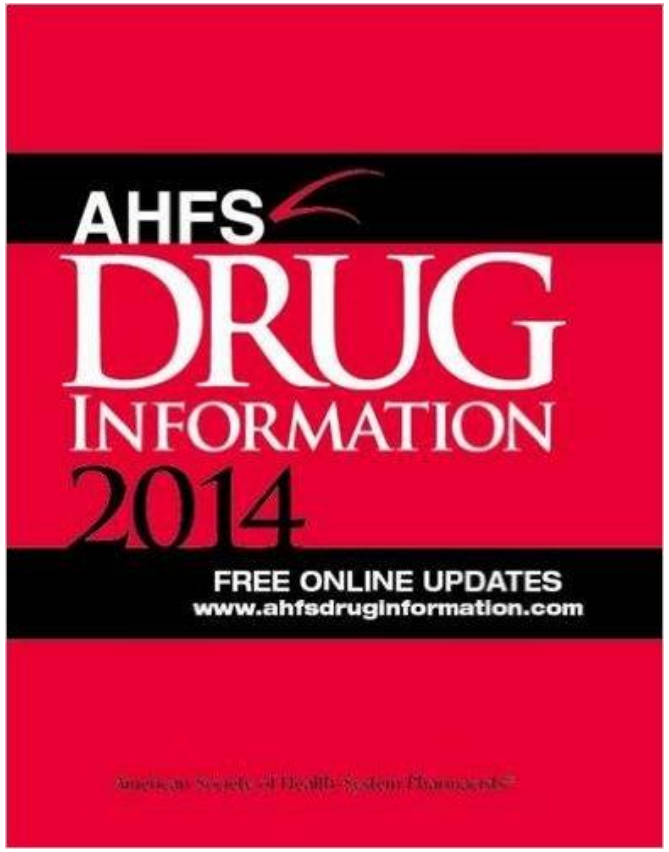
Systemic Therapy Program

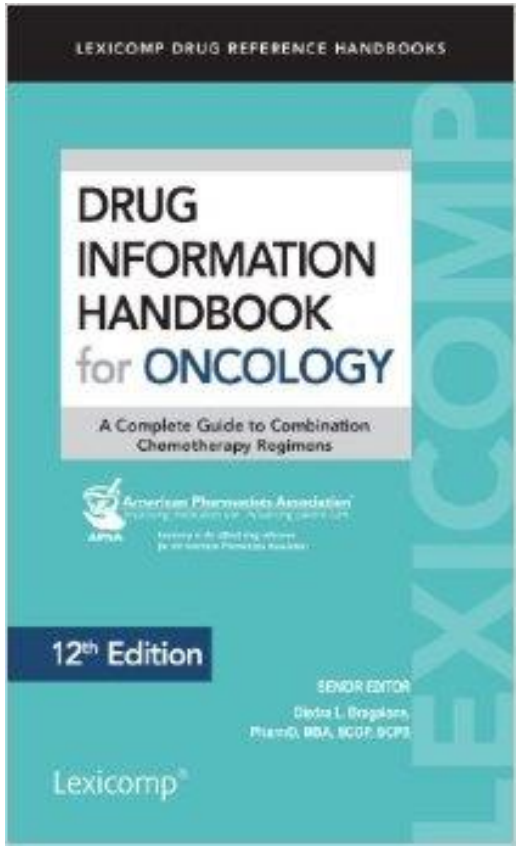
Policy & Procedure

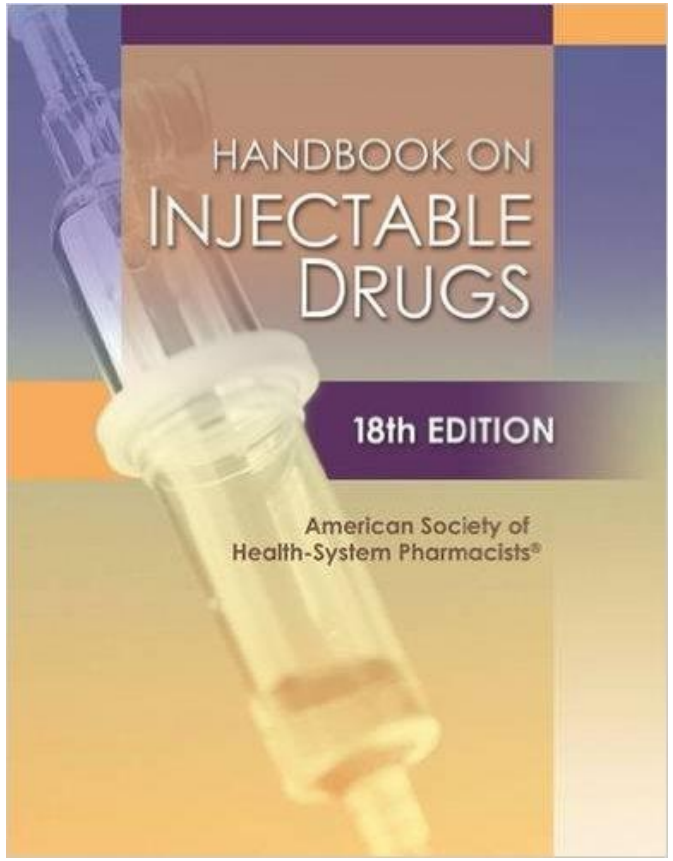
PREPARATION OF CANCER CHEMOTHERAPY



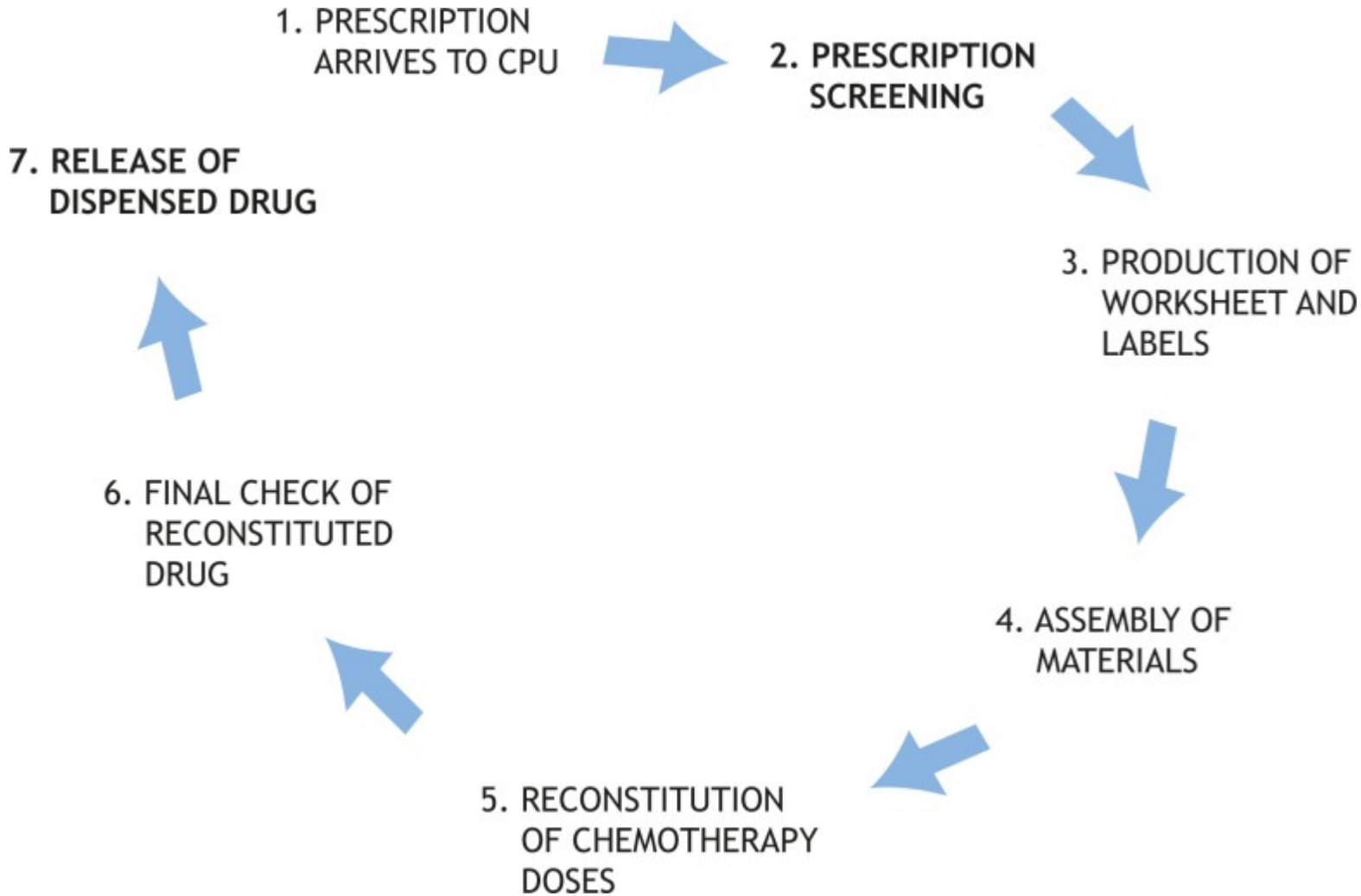
Standards and drug information preparation








Ranitidine/Cimetidine
Acetaminophen
Hydration


1. PRESCRIPTION ARRIVES TO CPU
2. PRESCRIPTION SCREENING
3. PRODUCTION OF WORKSHEET AND LABELS
4. ASSEMBLY OF MATERIALS
5. RECONSTITUTION OF CHEMOTHERAPY DOSES
6. FINAL CHECK OF RECONSTITUTED DRUG
7. RELEASE OF DISPENSED DRUG

Administration

- Administration remains a nursing mainstay, especially for parenteral drugs
  - Information on compatibilities with multiple infusion lines
  - Scheduling and sequencing
  - Infusion rates
  - Protocols for Extravasation antidotes
  - Premedications
    - Prehydration and forced-diuresis protocols in high-dose chemotherapy regimen
    - Prophylaxis with corticosteroids, antihistamine, and acetaminophen to avoid anaphylactic or allergic reactions for some special drugs
    - Prophylaxis protocols for NV

Monitoring and evaluation

- Pharmacists and nurses have demonstrated the ability to prevent potential adverse drug reactions by 50% and 40% respectively
- Monitor lab tests such as blood parameters , liver & renal function to assure within acceptable limits for the next cycle of chemotherapy
- Monitor patient for ADRs & toxicity and management protocols

Education

- Provide patient-specific education for patients and caregivers
  - OPSs can counsel new chemotherapy patients with a review of all the patient's medications, including prescriptions, over-the-counter, vitamins, and herbal products, for:
    - Drug–chemotherapy interactions, drug–drug interactions, duplicate therapy, and potential side effects.
  - Education on adverse effects, compliance with supportive care medications, and any lifestyle modifications, such as contraception, diet & …
  - Education on proper handling and storage of oral agents

Education

- Educate and train members of the multidisciplinary healthcare team
    - Participation in medical, nursing, pharmacy, and other allied health school curriculum in cancer care

Research

- Actively involved in the study design and protocol development for oncology clinical trials.

- This include particular attention to issues related to drug source/supplier; storage; preparation; dispensing; returns and disposal; stability and compatibility; administration; contraindications; adverse effects; and drug interactions

Our experience…

- A standard chemotherapy preparation unit for out patient and inpatient setting
- In this unit, three pharmacists and four pharmacy Technicians under supervision of a clinical pharmacist prepare about 200 chemotherapy drugs in a day

  - Check chemotherapy orders to prevent MEs
  - Patient education about chemotherapy regimen and adverse drug reaction and Preparation of educational pamphlets are other tasks of our pharmacists
  - 30 pamphlet and booklet

از مجموعه کتاب‌های آنچه باید درباره سرطان بدانیم (۲)

آنچه باید در مورد سرطان پستان بدانیم

نویسنده: دکتر زینب اشعری
زیر نظر: دکتر زهرا جهانگرد رفسنجانی

از مجموعه کتاب‌های آنچه باید درباره سرطان بدانیم (۲)

آنچه باید درباره عوارض شیمی درمانی بدانیم

نویسنده: دکتر زینب اشعری
زیر نظر: دکتر زهرا جهانگرد رفسنجانی

از مجموعه کتاب‌های آنچه باید درباره سرطان بدانیم (۵)

آنچه باید درباره لنفوم هوجکین بدانیم

نویسنده: دکتر زهرا خدابنده لو
زیر نظر: دکتر زهرا جهانگرد رفسنجانی

از مجموعه کتاب‌های آنچه باید درباره سرطان بدانیم (۴)

آنچه باید درباره سرطان کولورکتال بدانیم

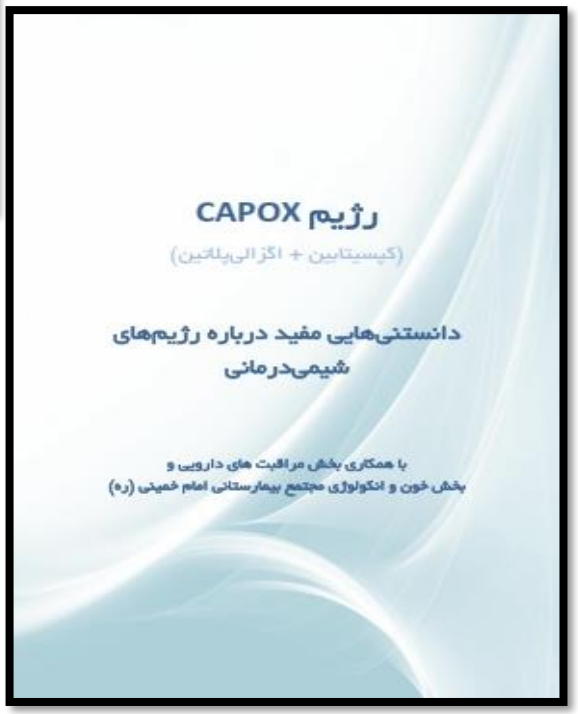
نویسنده: دکتر زینب اشعری
زیر نظر: دکتر زهرا جهانگرد رفسنجانی

از مجموعه کتاب‌های آنچه باید درباره سرطان بدانیم (۱)

احتیاطات لازم طی انجام شیمی درمانی

نویسنده: دکتر افسانه نوربندی
زیر نظر: دکتر زهرا جهانگرد رفسنجانی


رژیم DAC
(دوستاکسل+دوکسوروبیسین+سیکلوفسفامید)
دانستنی‌هایی مفید درباره رژیم‌های شیمی‌درمانی
با همکاری بخش مراقبت‌های دارویی و
بخش خون و انکولوژی مجتمع بیمارستانی امام خمینی (ره)


رژیم CAPOX
(کپسیتابین + اگزالی‌پلاتین)
دانستنی‌هایی مفید درباره رژیم‌های شیمی‌درمانی
با همکاری بخش مراقبت های دارویی و
بخش خون و انکولوژی مجتمع بیمارستانی امام خمینی (ره)


رژیم AC
(دوکسوروبیسین + سیکلوفسفامید)
دانستنی‌هایی مفید درباره رژیم‌های شیمی‌درمانی
با همکاری بخش مراقبت‌های دارویی و
بخش خون و انکولوژی مجتمع بیمارستانی امام خمینی (ره)


پکلی‌تاکسل (تاکسول)
دانستنی‌هایی مفید درباره داروهای شیمی‌درمانی
با همکاری بخش مراقبت‌های دارویی و
بخش خون و انکولوژی مجتمع بیمارستانی امام خمینی (ره)


Peha-taft classic

Conclusion

- Oncology pharmacists as the member of interdisciplinary team, offer a variety of services related to processes of medication management in oncology setting

- With the understanding and recognition of drug interactions and side-effects, pharmacists can provide timely interventions and information to health providers, as well as counseling to patients