Tech-Check-Tech Programs in Inpatient Hospitals: An Implementation Toolkit

The Tech-Check-Tech (TCT) Implementation Toolkit is the culmination of the tremendous work of the TCT Task Force commissioned in 2010 by the CSHP Board of Directors. At its inception, the Task Force was charged to:

1. Research the Board of Pharmacy regulation on the Tech-Check-Tech initiative; and current facilities utilizing the program to determine best practices in creating a Model that ensures feasibility for most health-system pharmacies.
2. Submit a model for evaluation and approval by the CSHP Board of Directors.
3. Develop educational talking points that demonstrate the benefits of Tech-Check-Tech in hospital pharmacies.
4. Determine the distribution of the new approved model to maximize its range.

Using a breadth of survey tools, research into current practices in other states and best practices in inpatient pharmacy technician, the Task Force developed this comprehensive resource to guide hospitals as they implement TCT.

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CSHP is profoundly grateful to these dedicated members and their contribution to Tech-Check-Tech.
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I. Overview

A. Description
This toolkit contains materials designed to assist inpatient hospitals with the implementation of Tech-Check-Tech (TCT) Programs. This toolkit was compiled by the California Society of Health-System Pharmacists (CSHP).

B. Audience
This toolkit is intended to provide inpatient hospital pharmacies the information necessary to implement a TCT program.

C. Goal of a TCT Program
The goal of a TCT program is to utilize specially trained pharmacy technicians to perform daily non-judgmental pharmacy functions and allow pharmacists to perform more clinical services.

D. Definitions

Automated Dispensing Cabinet (ADC)
A secured device that stores and distributes applicable medications upon request and requires an electronic personnel identification system.

Error in ADC or Cart fill
An occurrence of a wrong drug, dose, route, concentration, quantity, dosage form, expired medication, poor integrity of package, missing expiration date, missing auxiliary label, patient’s name missing from drawer and broken/crushed tablets in a line item (for ADCs) or a medication cart.

Line Item
A checking unit for ADC restocking (example: a single product of a specific drug and dose, regardless of quantity).

Tech-Check-Tech (TCT)
A program utilizing specially trained and qualified pharmacy technicians to check ADC medications and unit dose batches filled by other technicians.

Technician Checker
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An individual who has completed a TCT validation process and is currently authorized to check another technician’s work.

TCT Coordinator
The pharmacist responsible for assuring that all legal requirements of a TCT program are met. This may be the Pharmacist-in-Charge, Pharmacy Supervisor, Designated Pharmacist, etc.

Unit Dose
A physical quantity of drug product designed to be administered to a patient specifically labeled to identify the drug name, strength, dosage amount and volume, if applicable. Unit of use can be obtained from the manufacturer of the drug, repackaged from an external re-packager or repackaged on-site through a batch repackaging process that includes a registered pharmacist as a check. Unit dose examples include oral solids individually packaged by a manufacturer or re-packaged, oral liquids drawn up in a labeled oral syringe, injectable products and pre-mixed IV products. Unit dose cassettes or envelopes are modes of delivering a hospital inpatient’s medication doses for a predefined period of time, usually 24 hours. Cassette drawers or envelopes are labeled with the patient’s name and location and are typically delivered to the patient care area by a pharmacy technician.

II. History
Regulations enabling TCT programs in California became effective on January 5, 2007\(^1\).

Pharmacy technicians have however, been used in the hospital setting in California for decades and CSHP has advocated for the authority for hospitals to implement TCT programs for many years.

In 1991, California enacted statutory provisions allowing the use of Board of Pharmacy registered pharmacy technicians in the community pharmacy setting for the first time (AB 1244, Chapter 841, Statutes of 1991). This same legislation exempted technicians working in hospital settings from the registration requirements. Regulations were developed over the next year to implement this legislation – the statutory and regulations changes prohibited the longstanding practice in hospital settings of technicians checking technicians. Instead, a pharmacist was required to check the work performed by all pharmacy technicians whether in the inpatient or community pharmacy setting. Later, legislation was enacted that required pharmacy technicians in the hospital setting to become registered with the board as well (SB 1553, Chapter 798, Statutes of 1996).

In May 1998, the Long Beach Memorial Medical Center, Cedars-Sinai Medical Center and the UCSF School of Pharmacy requested a waiver from the board from CCR 1731 to conduct a two-year study to evaluate the effectiveness of TCT programs. The results of this study were published in the June 15, 2002 issue of the *American Journal of Health-System Pharmacy*, and found that certified pharmacy
technicians checking unit-dose cassettes were slightly more accurate (99.89%) than pharmacists performing the same task (99.52%).

In April 2004, Cedars-Sinai Medical Center and the UCSF School of Pharmacy requested a waiver from the Board of Pharmacy to conduct a two-year study to evaluate the impact of pharmacists preventing medication errors associated with prescribing and administering medications as a result of pharmacists being re-deployed from unit-dose medication cassette checking to clinical and professional functions. Pharmacists in the pilot sites used this time to provide direct patient care services and physician drug consultations. During the study, pharmacists intercepted 1855 errors, 682 of which prevented potential harm including the prevention of four deaths, the prevention of permanent harm in 28 patients, temporary harm in 590 patients and prevented an increase in the length of a patient’s hospital stay in 60 encounters. An additional 834 medication errors were prevented with the level of harm unspecified.

III. TCT - Regulatory Authority – CCR, Title 16, Division 17, Article 11, Section 1793.8

§ 1793.8. Technicians in Hospitals with Clinical Pharmacy Programs

(a) A general acute care hospital, as defined in Health and Safety Code 1250(a), that has an ongoing clinical pharmacy program may allow pharmacy technicians to check the work of other pharmacy technicians in connection with the filling of floor and ward stock and unit dose distribution systems for patients admitted to the hospital whose orders have previously been reviewed and approved by a licensed pharmacist.

(1) This section shall only apply to acute care inpatient hospital pharmacy settings.

(2) Hospital pharmacies that have a technician checking technician program shall deploy pharmacists to the inpatient care setting to provide clinical services.

(b) Compounded or repackaged products must have been previously checked by a pharmacist and then may be used by the technician to fill unit dose distribution systems and floor/ward stock.

(c) To ensure quality patient care and reduce medication errors, programs that use pharmacy technicians to check the work of other pharmacy technicians pursuant to this section must include the following components:

(1) The overall operation of the program shall be the responsibility of the pharmacist-in-charge.

(2) The program shall be under the direct supervision of a pharmacist and the parameters for the direct supervision shall be specified in the facility's policies and procedures.

(3) The pharmacy technician who performs the checking function has received specialized and advanced training as prescribed in the policies and procedures of the facility.
(4) To ensure quality, there shall be ongoing evaluation of programs that use pharmacy technicians to check the work of other pharmacy technicians.

IV. Suggested TCT Hospital and Technician Requirements

Hospital Requirements

A. When implementing a TCT program, the hospital pharmacy should:

1. Designate one pharmacist as the person responsible for assureing that all legal requirements associated with the TCT program are met. This person shall be called the TCT Site Coordinator. This may be the Pharmacist-in-Charge, Pharmacy Supervisor, Designated Pharmacist, etc.

2. Assure adequate staffing to support consistent utilization of the TCT program.

3. Develop written policies and procedures to guide the operation of the TCT program that may be made available to Board of Pharmacy inspectors upon request. The hospital should define a list of high-risk medications that may not be checked via the TCT program and include this list in the policy and procedure.

4. Incorporate the TCT program into the hospital pharmacy department’s general orientation process.

B. A TCT program is a tool to allow the re-direction of pharmacists from performing distributive tasks to cognitive tasks. It is designed to allow pharmacists to further improve patient safety by focusing on assessing the accuracy and appropriateness of the medications ordered and on educating staff and patients. A TCT program should not be used as a mechanism to reduce the number of pharmacist staff.

C. The Pharmacist-in-Charge shall review all records on an annual basis to assure compliance with the hospital’s TCT program policies and procedures.

Technician Eligibility

In order for a technician to participate in the TCT program, a technician may fall into one of the following categories:

A. A registered intern (in pharmacy school) with 6 months experience in unit dose filling.
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B. A technician working full or part time with one-year equivalent experience in unit dose filling.

Training
A. The participating hospital shall develop a TCT training module to formalize didactic training and quality control.

B. All technicians are required to undergo specific training to participate in the TCT program. The goal of this training process is to have the technician checker become validated and accomplish all the necessary didactic objectives. The training process may include the following:

1. Didactic lecture (or equivalent training with a self-learning packet)
2. Practical sessions (one-on-one training) that consist of observation of a pharmacist checking a unit dose medication batch and/or cart
3. Validation shall include “initial validation” and “on-going QA audits” performed quarterly for the first year; then once every six months

C. If at any time a TCT technician loses his/her validation, that individual shall be reassigned to another task until he/she is retrained and revalidated.

D. The practical session shall start with the trainee observing a technician checker performing either the unit dose batch or the ADC stocking check process. Then the trainee performs the initial check with a registered pharmacist verifying all doses. During the final stages of the practical session, the technician will complete the validation process. The training process will include introducing artificial errors into a live or simulated environment to monitor the ability of the technician to catch errors. Artificial errors introduced into the live environment, which are not corrected by the technician, shall be removed. The pharmacist overseeing the training sessions shall maintain initial validation and documentation for each validated TCT technician as well as notify the technician checker of any errors found during audits.

E. Development of individualized training programs will be the responsibility of each site in order to tailor the program to the patient population and medication distribution system of the institution. Assessment questions should be tailored to the site and be changed periodically as appropriate. It will be the responsibility of the TCT coordinator to ensure that all training is completed and documented. A summary report of each pharmacy technician trained as a technician checker will be kept on file by the TCT coordinator. Note: An organization may choose to place a copy of the training documentation in the employee’s personnel file.
V. TCT Process

A. A pharmacy technician fills the medication for the unit dose or Automated Medication Distribution System restocking batch.

B. A validated technician checker may check the accuracy of unit dose batches or automated medication distribution system restocks. The technician checker reviews the medications for the correct drug, dose, dosage form, quantity and reviews the expiration date.

C. If a filling error is found, the technician checker records the error and the product is given back to the technician who originally filled it (if available) or another technician. The technician then corrects the error and technician checker checks the correction. A pharmacist or another validated technician checker may check any dose corrected/filled by a technician checker.

D. If a validated checker is not available, then all doses shall be checked by a pharmacist.

E. This process continues until all doses have been checked.

VI. Validation Process

A. Initial Validation (and revalidation if needed)

1. Unit of Use Batch: For initial validation, the technician checker shall obtain a 99.8% accuracy rate in 1500 consecutive doses (divided in at least 5 separate audits). The audit process will consist of a registered pharmacist checking the accuracy of a unit of use medication after the technician has checked them. Any errors determined to be due to the improper checking by the technician checker will be documented and discussed with the technician. In each audit, the pharmacist will artificially introduce at least three errors. The pharmacist coordinating the audit will keep a record of the introduced errors to ensure that all are removed prior to distribution. All audit results will be documented by the pharmacist and kept in the quality assurance file. Errors will include an occurrence of a wrong drug, dose, route, concentration, quantity, dosage form, expired medication, poor integrity of package, missing expiration date, missing auxiliary label, patient’s name missing from drawer and broken/crushed tablets. Each dose will count as one error. If the technician checker misses more than three errors in 1500 doses, they fail the validation.
2. **ADC**: For initial validation, the technician checker shall obtain a 99.8% accuracy rate in 500 total line items (divided in at least 5 separate audits). The audit process will consist of a registered pharmacist checking the accuracy of the ADC medications after the technician has checked them. Any errors determined to be due to the improper checking by the technician checker will be documented and discussed with the technician. In each audit, the pharmacist will artificially introduce at least three errors. The pharmacist coordinating the audit will keep a record of the introduced errors to ensure that all are removed prior to distribution. All audit results will be documented by the pharmacist and kept in the quality assurance file. Errors will include an occurrence of a wrong drug, dose, route, concentration, quantity, dosage form, expired medication, poor integrity of package, missing expiration date, missing auxiliary label, patient’s name missing from drawer, and broken/crushed tablets. Each dose will count as one error. If the technician checker misses more than one error in 500 doses, they fail the validation.

**VII. Quality Assurance Process**

A. The hospital TCT Coordinator shall maintain documentation of the quality assurance checks (audits). Audits should be conducted in the same manner as in the initial validation process. The audits should occur at random and unannounced times. The audit sample should be at least 300 doses for the unit of use batch and 100 line items for the ADC batch. To maintain validation, no more than one error can be made. The audit reports should include each specific error encountered, the total number of errors, the total number of doses or line items checked and the percent error rate. Once the technician has successfully completed three consecutive monthly audits, specific audits for that technician may be reduced to quarterly for a period of one year. After a year, audits can be reduced to semi-annually. If a technician does not perform the TCT duties for more than six months, that technician should be revalidated.

B. If a validated technician checker fails any of the audits, the audit should be repeated in the same month. If the technician fails the re-audit, they should be reassigned to another duty and should be revalidated prior to checking any more doses.

**VIII. Sample Tech-Check-Tech Training Module**

A. **Purpose**
   
   This sample training module provides a template of the information necessary to meet the required didactic, process orientation training and quality control necessary to
participate in a TCT program. This information is intended to be combined with one-on-one training on automated batch, cart fill and pre-made IV checking processes.

B. **Program Overview**
Train technician on TCT requirements and the hospital's TCT program.

C. **Training – Checking**
Upon completion of this portion of training, the pharmacy technician will be able to:

- Identify the information required on the label of extemporaneous products packaged by the pharmacy.
- Differentiate between the packaging, labeling and product characteristics for various oral, injectable and intravenous medications.
- Identify expired or contaminated products.
- List the main product characteristics that need to be checked for each drug packaged by the pharmacy.
- Identify products requiring special handling or special storage conditions.
- Identify the generic names associated with common brand names through the use of common references.
- State the appropriate size of common bulk items to be dispensed.
- Describe how ADCs work and their associated risks and limitations (where applicable).

1. **Therapeutic Drug Classifications**

   a. **Antihistamines**
   These drugs provide symptomatic relief of allergic symptoms and common cold symptoms. They can be used as a sedative, antiemetic or for motion sickness. These drugs antagonize histamine.

   b. **Anti-Infective drugs**
   These drugs will kill or stop the growth of infective organisms in the body. This group includes anti-viral, antibacterial and anti-fungal agents.

   c. **Antineoplastic Drugs**
   These types of drugs are known as chemotherapy. They are used in cancer treatment, often in conjunction with surgery, radiation therapy or immunotherapy. They affect cell growth by several different mechanisms.

   d. **Autonomic Drugs**
i. Parasympathomimetic (cholinergic): These drugs increase muscle tone of the smooth muscles of the bladder and gastrointestinal tract. They are used for urinary retention and to increase gastric motility.

ii. Parasympatholytic (cholinergic blockers): These drugs inhibit motility of the gastrointestinal tract and urinary tract. They also decrease secretions of the body (saliva, pancreatic, gastric). These drugs are commonly used before surgery.

iii. Sympathomimetic (adrenergic): These drugs can be bronchodilators by relaxing bronchial smooth muscle by stimulation of beta-2 adrenergic receptors. These drugs can cause cardiac stimulation (increase the force of contraction) by acting on beta-1 adrenergic receptors. They can also cause vasoconstriction by acting on alpha-receptors (nasal decongestants) and vasodilatation in skeletal muscle.

iv. Sympatholytic (adrenergic blockers): These drugs block alpha-adrenergic action. They cause direct stimulation of smooth muscle (vasoconstriction) and vasodilatation by direct relaxation of vascular muscle.

v. Skeletal Muscle Relaxants: These drugs are generally central nervous system (CNS) depressants, which have sedation and skeletal muscle relaxant effects.
e. Blood Formation and Coagulation Drugs
   i. Antianemia: Iron is needed by our body in hemoglobin so we can utilize oxygen in our blood.
   ii. Anticoagulants: Warfarin prevents harmful clot formation in blood vessels by decreasing the activity of certain clotting factors. Heparin is used when an immediate effect is required. It can be used for treatment or prevention of clots. Protamine is a heparin antagonist. It neutralizes heparin activity by binding to it.

f. Cardiovascular Drugs
   i. Cardiac Drugs: These drugs have several actions, which affect the heart. Some are antiarrhythmic drugs. They are used in life threatening arrhythmias, such as suppressing ventricular or arterial fibrillation, flutter, or tachycardia. Other drugs increase the force and speed of the contraction of the heart. They help in congestive heart failure. Some drugs block beta-adrenergic receptors in the heart (beta-blockers slow down heart rate). They also reduce blood pressure and are useful in angina pectoris, cardiac arrhythmias and migraine headaches.
   ii. Antilipemic Agents: These drugs are used to decrease elevated serum cholesterol and triglyceride levels.
   iii. Hypotensive Drugs: These drugs are used in the treatment of hypertension. Diuretics are usually used first, and then other types of medications are added if necessary. Some are vasodilators, others affect the autonomic system and some are beta-blockers.
   iv. Vasodilating Drugs: These drugs are used as coronary vasodilator to treat angina pectoris. Some are used for long-term prophylactic management and others for acute relief.

g. Central Nervous System Drugs
   i. Analgesics and Antipyretics: This large group of drugs kills pain and decreases fever in the body. Narcotics are also in this category. Narcotics analgesics may produce physical dependence. Nonsteroidal anti-inflammatory agents represent a large newer group of painkillers.
   ii. Anticonvulsants: These drugs are used to reduce the frequency and/or severity of seizures in epilepsy.
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h. *Psychotherapeutic Drugs:* Antidepressants are used in endogenous depression and other depressive illnesses. Tranquilizers are used in acute and chronic psychoses, including schizophrenia. Some have other uses in hiccups and as antiemetics. Hydroxyzine is used to relieve anxiety, control emesis and reduce narcotic requirements following surgery.

i. *Sedatives and Hypnotics:* These drugs are used to treat insomnia, relieve anxiety and provide routine sedation. They cause CNS depression. Barbiturates can cause physical and psychological dependence. Benzodiazepines are used for anxiety, insomnia and as anticonvulsants and skeletal muscle relaxants.

2. *Drug Classifications*

   a. Controlled substances

      i. CI
      ii. CII
      iii. CIII
      iv. CIV
      v. CV

   b. Non-Controlled medications

3. *Generic vs. Brand names*

   a. Identify the generic names associated with common brand names through the use of common references (i.e. Lexi-Comp, Micromedex, American Hospital Formulary Service, Drug Facts and Comparisons).

   b. During the drug development process, a medication is given a generic and chemical name. Once the FDA approves the drug, the manufacturer proposes a brand name for their form of the drug. During the patent life of the drug, no generic forms are made; therefore, ordering the drug by brand name is the same as ordering it by generic name. In general, generic forms of medications are used whenever possible. Therefore, drugs should be referred to whenever possible by the generic name. Cart fill lists and ADC fills should always list the generic name of the drug.
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c. Generic and brand names can be found in common references. Identify common drugs and their brand names. Common references may include:
   i. Micromedex
   ii. American Hospital Formulary Service
   iii. Pediatric dosage handbook
   iv. Drug Facts and Comparisons

4. Special handling or storage conditions

a. Some products may require special handling or storage conditions. Identify products requiring special handling or storage condition, such as:
   i. Protect from light; Refrigerate; Do Not Refrigerate; Chemotherapy – Dispose of Properly, etc.

5. Product Characteristics

a. IV products: colorless or lightly colored clear solution (in general); exceptions to this include imipenem/cilastatin (Primaxin) and rifampin

b. Oral products: can be colorless or densely colored; suspensions are cloudy and may tend to separate out to form more than one layer.
   i. Example: furosemide (Lasix) – oral solution is yellow/orange and IV preparation is a clear solution  
   ii. Some drugs (suspensions) may separate out (precipitate) and cannot be re-suspended

c. Identify expired or contaminated products.
   i. Expiration dates should be checked on each dose of medication. If the packaged (unit dose) is from the manufacturer, this date should be on that packaging.
   ii. Some products have special stability characteristics or are prone to contamination because of packaging

d. Identify the product characteristics that need to be checked for each medication dispensed by the pharmacy:
   i. Right dose
   ii. Right strength
   iii. Right number of unit doses
   iv. Right drug
6. *Dosage Forms*
   a. Identify medications with various dosage forms.

   b. Some medications have unique dose forms. This affects how the drug can be given (e.g. whether or not it can be crushed or split). Examples include:
      i. nifedipine (Procardia XL) is a matrix tablet that slowly releases the medications from a “web-like” structure through a special hole in the tablet coating into the GI tract.
      ii. valproic acid (Depakote Sprinkles) are small beads that slowly release the drug in the small intestine; they shall not be chewed but can be sprinkled on soft food and swallowed.

   c. In caring for children and adults with special needs, we often may use/create dosage forms that are unique to our patient population. Examples include IV dilutions and oral liquid medications not available from the manufacturer.

7. *Expiration Dates*
   a. Identify examples of commonly missed expiration dates.

   b. Expiration dates should be visible on each individual dose. Items that are normally stored in the refrigerator should be marked with the appropriate expiration for room temperature. All outdated medications should be considered an error in the cart fill or ADC fill.

8. *Labels*
   a. Identify examples of correct product labeling.

   b. Information required on the label of extemporaneous products (including draw-up doses for cart fill) dispensed by the pharmacy (for inpatient use) includes:
      i. Generic/trade name of drug
      ii. Strength of drug
      iii. Special instructions
      iv. Dose
      v. Expiration date
      vi. Manufacturer lot number & hospital lot number
c. Various dosage forms require specific packaging and storage because of the stability or other characteristics of the drug and should be noted on the label.

D. Training – Accuracy and Medication Errors
Upon completion of this portion of training, the pharmacy technician will be able to:

- Explain the potential impact of the variety of medication errors by reviewing a sample of past errors as reported in nationally distributed periodicals, such as Hospital Pharmacy and Institute for Safe Medication Practices Medication Safety Alert newsletters as well as those experienced at the participating hospital.
- Differentiate and identify various dosage forms.
- Describe the training, validation and audit process for technicians participating in the TCT program, including accuracy requirements.
- Describe the use of the pharmacy and nursing profile systems (including the Medication Administration Record if used as a checking document).

1. Common Workplace Errors
a. Understand the potential impact of medication errors by reviewing past errors as reported in Hospital Pharmacy as well as ISMP.
   b. Medication errors are episodes of a drug inaccuracy that should be preventable through effective system controls involving pharmacists, physicians, other prescribers, nurses and others. It is the responsibility of all staff to prevent medication errors through accurate job performance.

2. Look-a-like Sound-a-like medications (LASA medications)
   a. Identify LASA medications.
      i. Ampicillin / Amoxicillin
      ii. Nifedipine / Nicardipine
      iii. Timentin / Ticar
      iv. Potassium Chloride / Potassium Gluconate
      v. Dopamine / Dobutamine

3. Route of Administration
   a. Identify common errors with routes of administration.
4. *Dilution Errors*
   a. Identify possible errors with multiple concentrations.

   b. Many medications have more than one concentration available. This may result in an overdose or underdose of the medication.

5. *Abbreviations*
   a. Recognize and identify various abbreviations:

      i. **Common medical abbreviations and symbols used in Pharmacy:**
         1. MS = morphine sulfate  Na = sodium
         2. K = potassium  Ca = calcium
         3. Mg = magnesium  Cl = chloride
         4. SO4 = sulfate  PO4 = phosphate
         5. HCO3 = bicarbonate  D5W = 5% dextrose (in water)
         6. NS = normal saline  LR = lactated ringers

      ii. **Common abbreviations related to drug strength:**
          1. g = grams (also abbreviated incorrectly as G or gm)
          2. mg = milligrams (1/1000 of a gram)
          3. mcg = micrograms (1/1000 of a milligram)
          4. mEq = milliequivalents
          5. U = improper abbreviation for units
          6. Gr = grains, an apothecary volume measure = 60 mg
          7. kg = kilograms = 1000g = 2.2 pounds

      iii. **Common abbreviations related to volume:**
           1. L = liter (1000 ml)  mL = milliliter (often written as cc)
           2. gtt = drop (not drip)  dram = 5 ml = 1 teaspoon
           3. oz = ounce = 30 ml  ss = ½ (ss oz = ½ oz)

      iv. **Common abbreviations related to route:**
           1. PO = oral
           2. IM = intramuscular (a “shot”)
           3. SQ = SC = SubQ = subcutaneous (under the skin)
           4. IV = intravenous (into the vein)
           5. IT = intrathecal (into the spinal fluid)
           6. PR = rectal
iv. Common abbreviations related to route (continued):

7. **AU** = both ears  **OU** = both eyes
8. **AD** = right ear  **OD** = right eye
9. **AS** = left ear  **OS** = left eye
10. **GT** = via gastrostomy tube
11. **NG** = via nasogastric tube
12. **NJ** = via nasojejunal tube
13. **JT** = via jejunostomy tube

The difference between the above tubes is based on their point of entry and at the point in which the end is located. The nasojejunal and nasogastric tubes are temporary tubes that are inserted through your nose. The gastrostomy and jejunostomy tubes are permanent tubes that are implanted (surgically) through the skin. GTs and NGs continue down into the stomach and end there. JTs and NJs end in your upper small intestine (jejunum).

v. Common abbreviations in Frequency:

1. **q** = every or each  **qd** = every day
2. **BID** = twice a day  **TID** = three times a day
3. **QID** = four times a day  **PRN** = as needed
4. **h** = hr = hour  **q2h** = every 2 hours
5. **AC** = before meals  **PC** = after meals

vi. The following are usually site specific. There may be several different meanings for each.

1. **STAT**  Demand
2. **ASAP**  IRR

E. **Training – Calculations**

Upon completion of this portion of training, the pharmacy technician will be able to:

- Demonstrate an understanding and a working knowledge of the basic mathematical principles involved in pharmacy calculations, including: Fractions, Percentages, Proportions, Significant figures
- Make mathematical conversions between and within the Metric, Avoirdupois, and Apothecary systems.
- Fraction: a way of describing a portion of a whole (e.g. 1/2 or 3/8)
- Percentages: a way of describing a portion out of a hundred (e.g. 50%, 72%).
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• Proportions: the relation of one part to another or to the whole – often described by a fraction or percentage (e.g. 1:1000 vs. 1:10000).

1. Practice calculations
   a. Sample exam – the TCT coordinator should change the questions and examples on a periodic basis

b. Please complete the following exercises. The answers are included for your education.
c. Section 1
   i. 8 mg = ______________g
   ii. 4 g = ______________mg
   iii. 5000 g = ______________kg
   iv. 30 mg = ______________g
   v. 40 cc = ______________mL
   vi. 0.95 L = ______________mL
   vii. 0.8 L = ______________cc
   viii. 900 cc = ______________L
   ix. 6 mL = ______________L
   x. 60 mL = ______________cc

d. Section 2

Calculate the following dosages. Round your answer to the nearest tenth.
i. Acetaminophen (Tylenol) elixir 160 mg/5 mL
   Dose: 480mg
   How many mL?

ii. Albuterol liquid 2 mg/5 mL
   Dose: 8 mg
   How many mL?

iii. Furosemide 10 mg/mL
    Vial size: 20 mL
    Total vial strength?

iv. Dexamethasone 125 mg/10 mL
    Concentration per mL?
v. Lidocaine 1% injection 10mL vial
   What is concentration in mg/ml?

vi. Midazolam 2 mg/2 mL
    What is the concentration per mL?

vii. Bumetanide injection 0.25 mg/mL
     Dose: 3 mg How many mL?

viii. Carbamazepine 200 mg
      Dose: 2 tab TID
      How many tablets are needed for 24 hours?

ix. Metformin HCL 850 mg
    Dose: 1 tab BID PC
    How many tabs and when does the patient receive the doses?

x. Methylprednisolone 40 mg/1 vial
    Dose: 80 mg q4 hrs
    How many vials are needed?

e. Answers

<table>
<thead>
<tr>
<th>Section 1</th>
<th>Section 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. 0.008</td>
<td>i. 15 mL</td>
</tr>
<tr>
<td>ii. 4000</td>
<td>ii. 20 mL</td>
</tr>
<tr>
<td>iii. 5</td>
<td>iii. 200 mg</td>
</tr>
<tr>
<td>iv. 0.03</td>
<td>iv. 12.5 mg/mL</td>
</tr>
<tr>
<td>v. 40</td>
<td>v. 10 mg/mL</td>
</tr>
<tr>
<td>vi. 950</td>
<td>vi. 1 mg/mL</td>
</tr>
<tr>
<td>vii. 800</td>
<td>vii. 12 mL</td>
</tr>
<tr>
<td>viii. 0.9</td>
<td>viii. 6 tabs</td>
</tr>
<tr>
<td>ix. 0.006</td>
<td>ix. 2 tabs daily, 1 after each meal</td>
</tr>
<tr>
<td>x. 60</td>
<td>x. 12 vials</td>
</tr>
</tbody>
</table>
F. Sample Test Questions

On the following pages are sample test questions than may be used to assess competency with the TCT training module. As with the module, the tests may be altered to fit site specific information. The questions should be changed periodically.

i. T/F: The California Board of Pharmacy established a law that stated a pharmacy technician could check patient unit dose carts.

ii. T/F: The intent of the program is to allow pharmacists additional time to provide clinical activities, including the provision of direct patient care, while increasing pharmacist job satisfaction.

iii. What year did the California Board of Pharmacy enact the provisions allowing TCT program?
   a. 1989
   b. 2002
   c. 1995
   d. 2007

iv. T/F: Compounded or repackaged products DO NOT have to be previously checked by a pharmacist.

v. Which of the following is NOT TRUE regarding participation in a TCT program:
   a. The overall operation of the program shall be the responsibility of the pharmacist-in-charge.
   b. Only acute care inpatient hospital pharmacies may participate in a TCT program.
   c. A pharmacy technician who participates in the TCT program has received specialized and advanced training.
   d. A pharmacy technician may oversee the TCT program and does not need to be under direct pharmacist supervision.

Answers

i. True
ii. True
iii. D
iv. False
v. D
Tech-Check-Tech (TCT) Programs in Inpatient Hospitals: An Implementation Toolkit

References


Appendix 1
TCT Training Checklist (Sample)

Technician Name: ____________________________ Date: ________________

• **Qualifications**: (check all that apply)
  __ A registered intern (in Pharmacy school) with six month’s experience in Unit Dose filling
  __ A technician working full or part time in Unit Dose filling with one year’s equivalent experience
  __ Other

• **Areas trained in as a Technician**: (check all that apply)
  __ IV  __ First Fill  __ Cart Fill
  __ UD  __ OR  __ ED
  __ ADC  __ Billing  __ Purchasing
  __ Other __________

• **TCT Training**
  Didactic completed: ________________________ (enter date)
  Process (1:1) completed: ________________________ (enter date)
  Quizzes completed: ________________________ (enter date)
  Initial validation completed: ________________________ (enter date)
  T-C-T Training completed: ________________________ (enter date)
  On-Going validations scheduled: ________________________ (enter dates)
    *(recommended quarterly for first year, then yearly thereafter)*
To obtain TCT validation, a 99.8% accuracy rate should be achieved.

Unit of Use Batch: Should achieve required accuracy rate in 1500 consecutive doses (divided in at least 5 separate audits). If candidate misses more than three errors they will fail the validation process.

ADC Batch: Should achieve required accuracy rate in 300 doses for unit of use and 100 line items in an ADC batch. If candidate misses more than one error they will fail the validation process.

A medication error when checking is considered any one of the following:
1. Wrong drug
2. Wrong dose
3. Wrong route
4. Wrong concentration
5. Wrong quantity
6. Wrong patient
7. Wrong dosage form
8. Expired medication
9. Poor integrity of product
10. Missing expiration date
11. Missing auxiliary label
12. Patient’s name missing from drawer
13. Broken/crushed tablets

<table>
<thead>
<tr>
<th>Date</th>
<th># of Doses</th>
<th># of Errors</th>
<th>Accuracy %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>
Appendix 3
TCT Audit Tool (Sample)

Date of audit: __________________________
TCT Technician being audited: __________________________
Pharmacist conducting audit: __________________________

<table>
<thead>
<tr>
<th>Introduced Errors: Medication</th>
<th>QTY</th>
<th>Area (ADC, Unit of Use; etc.)</th>
<th>Description of Error</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

Audit Results

<table>
<thead>
<tr>
<th># of Dose</th>
<th># of Error</th>
<th>Description of Error</th>
<th>Accuracy %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>
Appendix 4
Tech-Check-Tech Monthly/Quarterly/Annual QA Tracking Form
(Sample)

TCT Technician Name: ________________________________

Each new TCT should complete 1500 consecutive doses (in 5 separate audits) of Unit of Use batch fill/Cassette Fill and 500 doses of ADC medication fills (in 5 separate audits) and obtain a 99.8% accuracy rate to become/remain validated.

<table>
<thead>
<tr>
<th>Date</th>
<th># Doses</th>
<th># Errors</th>
<th>% Acc.</th>
<th>RPh</th>
<th>Description of Error(s)</th>
</tr>
</thead>
<tbody>
<tr>
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</table>
Appendix 5
Tech-Check-Tech Annual Re-certification (Sample)

Technician’s Name: ____________________________ Date: ____________

1. Fillers
   • Please document those errors that you seeded.
   • Please give this form directly to the pharmacist working in the area the errors are seeded.

2. Pharmacist
   • Please check the cart after the technician has completed checking and identify if the following errors were corrected.

<table>
<thead>
<tr>
<th>Error #1 Seeded</th>
<th>Patient’s Room Number (Filler tech complete)</th>
<th>Drug Name/Dose (Filler tech complete)</th>
<th>Indicate the Medication Error Seeded (Filler tech complete)</th>
<th>Did the Technician Checker identify the error and correct it. (Pharmacist complete)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>❑ Wrong drug</td>
<td>❑ Drug expired</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>❑ Wrong dose</td>
<td>❑ Wrong concentration/strength</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>❑ Wrong quantity</td>
<td>❑ Correct Drug/Wrong Patient</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>❑ Wrong dosage form</td>
<td>❑ Missing Drug</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>❑ Robot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error #2 Seeded</td>
<td></td>
<td>❑ Wrong drug</td>
<td>❑ Drug expired</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>❑ Wrong dose</td>
<td>❑ Wrong concentration/strength</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>❑ Wrong quantity</td>
<td>❑ Correct Drug/Wrong Patient</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>❑ Wrong dosage form</td>
<td>❑ Missing Drug</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>❑ Robot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error #3 Seeded</td>
<td></td>
<td>❑ Wrong drug</td>
<td>❑ Drug expired</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>❑ Wrong dose</td>
<td>❑ Wrong concentration/strength</td>
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<tr>
<td></td>
<td></td>
<td>❑ Wrong quantity</td>
<td>❑ Correct Drug/Wrong Patient</td>
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<td></td>
<td></td>
<td>❑ Wrong dosage form</td>
<td>❑ Missing Drug</td>
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<td>❑ Robot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error #4 Seeded</td>
<td></td>
<td>❑ Wrong drug</td>
<td>❑ Drug expired</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>❑ Wrong dose</td>
<td>❑ Wrong concentration/strength</td>
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<tr>
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<td></td>
<td>❑ Wrong quantity</td>
<td>❑ Correct Drug/Wrong Patient</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>❑ Wrong dosage form</td>
<td>❑ Missing Drug</td>
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<td>❑ Robot</td>
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</tr>
<tr>
<td>Error #5 Seeded</td>
<td></td>
<td>❑ Wrong drug</td>
<td>❑ Drug expired</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>❑ Wrong dose</td>
<td>❑ Wrong concentration/strength</td>
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<td></td>
<td>❑ Wrong quantity</td>
<td>❑ Correct Drug/Wrong Patient</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>❑ Wrong dosage form</td>
<td>❑ Missing Drug</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>❑ Robot</td>
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</tr>
</tbody>
</table>

Total no. of seeded errors: ____________________________  Total no. of doses: ____________

No. of seeded errors not caught: ____________________________

Accuracy rate: ____________________________