Dear New Employee,

Welcome to Cape Fear Valley Health. We look forward to having you as a member of the health care team.

All registered nurses, licensed practical nurses, ED Paramedics and LifeLink EMTP’s are required to take a medication administration examination prior to employment. This test requires your full concentration, so please make arrangements for childcare. Failure to successfully pass the examination after two attempts will result in withdrawal of the employment offer. You may reapply after three months.

The exam will cover the entire medication review packet. The exam is administered in the Education Center at 3418 Village Drive. Your recruiter will schedule the test with you when an offer of employment is made. Parking is available in the Education Center parking lot.

Attached is a copy of the medication administrative policy and a calculation exercise packet. Review the policy and take time to work through the problems. The test questions will be similar. For online assistance you can Google: math review for nurses. There are multiple websites listed that can provide assistance with medication questions and calculations.

The Training and Development Department staff looks forward to assisting you in your educational endeavors. Please contact Michael McLean with questions at 910-615-4754 or mmcle2@capefearvalley.com.

Sincerely,

Shandra Mitchell, BSN, RN-BC
Nursing Core Orientation Coordinator

12 January 2012
POLICY: Cape Fear Valley Health System (CFVHS) is committed to the safety of its medication use environment. As such, medications are accessed and administered for each patient singly and separately. Further, aspects of medication administration comply with North Carolina law and regulations governing the practice of nursing.

PURPOSE: Consistent approach to safe medication administration minimizes the opportunity for patient injury, maximizes positive patient outcomes and diminishes hospital liability exposure.

ADMINISTRATIVE RESPONSIBILITY: Nursing administration approves the medication/calculation exam administered by the Training and Development Department prior to employment. The compliance of unit staff is a joint responsibility of the individual licensed nurse and the Department Manager.

The medication administration policy is divided into 14 sections to provide faster retrieval of the specific information needed:

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<td>* MEDICATION ADMINISTRATION &amp; LABELING INPATIENT AND NONPROCEDURAL AREAS (Diagram)</td>
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Refer to Pharmacy Policies:
- PATIENT'S OWN MEDICATION
  - Pharmacy Policy # 30:09
- AUTOMATIC STOP ORDERS FOR MEDICATIONS
  - Pharmacy Policy # 30:21
- MEDICATION OCCURRENCES
  - Pharmacy Policy # 10:22
- STANDARD MEDICATION ADMINISTRATION SCHEDULE
  - Pharmacy Policy # 30:14
- INVESTIGATIONAL DRUG APPROVAL and INVESTIGATIONAL DRUG PROCEDURES
  - Pharmacy Policy # 35:11 and Pharmacy Policy # 10:19
- FLOOR STOCK MEDICATIONS
  - Pharmacy Policy # 30:13
- ADVERSE DRUG REACTIONS
  - Pharmacy Policy # 10:13
- DRUGS SENT HOME WITH PATIENTS
  - Pharmacy Policy # 10:16

Reviewed/Revised:
10/18/96   02/15/02   08/03/06  01/05/11
01/06/97   10/01/02   04/05/07  07/19/11
11/04/97   04/25/03   12/07/07  1/11/12
06/11/99   09/30/04   04/04/08
10/08/99   02/15/05   03/16/09
04/15/00   11/17/05   04/16/09
02/12/00   02/23/06   08/20/09
11/09/01   05/22/06   06/17/10

Reviewed/No Change:   Department  Was the Policy Replaced with Another Policy  If Yes, Old Policy Title:

PROCEDURE:
I. GENERAL POLICY:
   A. Licensed Nursing staff and EMT-Paramedic from LifeLink are required to pass the medication administration test (see "Orientation" Human Resources policy). Medication administration tests may also be required at the division level, based on the area of practice.

   B. Medication orders are originated by a License Independent Practitioner (LIP)/dentist or his/her designee, Nurse Practitioner or Pharmacist as defined in the "Who may prescribe medications" pharmacy policy # 10:05. Orders and transcription of orders are written legibly. A signature is written/printed legible and/or use of the Hospital stamp.

   C. Orders are completed using: drug name, dose, route and frequency. PRN medication orders specify reason for medication and parameters, if appropriate.

   D. Clarify incomplete or vague orders BEFORE drug administration. Do not alter orders. Rewrite clarification orders. Do not use unapproved abbreviations.

      *See Prohibited list on Infoweb: Reference section: Abbreviation Reference list: Prohibited list.

   E. When transferring a patient, a copy of the current Medication Reconciliation /Transfer Form is completed prior to transfer to the new unit.

   F. Remove medications from the Pyxis for one patient at a time and administer to each patient separately, adhering to the “five rights of medication” administration as follows:

      1) right patient  4) right route
      2) right medication  5) right time
      3) right dose

   G. UNIT DOSES or PATIENT-SPECIFIC DOSES of oral medications remain in the manufacturer’s (or pharmacy’s) packaging up to the point of actual drug administration at the bedside (or anteroom for isolation patients) so a final check of the drug against the MAR can be accomplished.

      Exception: Medications that need to be crushed may be removed from the original packaging; however, this packaging should remain with the crushed product up until the point of administration.

   H. Medication Labeling:

      1) The orange/red "Drug Added" sticker is completed and affixed to the IV bag as soon as medication is added.
      2) ** At no time are additional medications added to bags prepared by Pharmacy (these are added under a laminar flow hood).
      3) If the person who prepared it does not immediately administer medication, label the medication upon transferring it from the original packaging to another container.
         a. Labeling includes the medication name, strength, and amount- if not apparent by the container. Include expiration date on the label if it will not be used within 24 hours or when the expiration date is less than 24 hours.
         b. Verify all medications both, verbally and visually, by two qualified individuals when the person preparing it is not the person administering it.
         c. Refer to pharmacy policy “Personnel authorized to administer medications”
      4) Discard any unlabeled medications immediately.
5) See Attachment 1 at end of same policy titled “Medication Administration Process and Medication Labeling”.
6) IV tubing is labeled “High Alert Medication”. Label is attached to IV tubing. Refer to Pharmacy policy “High Alert Medications”.

I. After consulting with a Pharmacist and a drug reference, the nurse has the responsibility to question and/or refuse to administer an ordered medication if she/he feels the drug, dosage, or the route may be detrimental to the safety of the patient. Notify Supervisory personnel (via chain of command) of such situations as soon as nurse can reasonably do so.

J. Identify patients prior to medication administration. Refer to Administrative “Patient Identification” policy

K. Record medications on the MAR/MAK as soon as given, held or omitted.

L. Medications ordered with parameters, i.e., such as diastolic greater than 120, are assessed on the ordered frequency i.e., q4h, q8h, q6h, etc., and marked as given or held. Document rationale for decision (i.e., can be as simple as writing BP next to time metoprolol PRN given). Comments such as patient response, further intervention, etc., are documented in the nurse’s notes or MAK as appropriate.

II. SECOND NURSE VERIFICATION:
Nurse has a double-check system, which includes two licensed nurses, one being a RN, to verify IV set-up, medication and IV pump settings.

A. High alert medications and specific critical medications require a second licensed nurse, one being a RN, to check the five rights before administration or any time a change in medication is ordered by LIP.

1) Refer to Pharmacy policy “High Alert Medications: 10:04A”
2) Refer to Nursing Policy “Critical Medication Guidelines for the Adult Patient of Cape Fear Valley Hospital (excluding Emergency Department)”

B. Include the initials of the two nurses checking the medications on the MAR/Flow sheet. Units utilizing the Medication Administration Check (MAK) scan the bar code on the nurse’s badge.

1) Refer to Human Resources Policy “Behavior of Employees” for disciplinary action used for inappropriate use of badging scanning procedure.
2) Refer to Section H: Medication Labeling in this policy regarding IV tubing labeling.

III. MULTIPLE DOSE VIALS:
A. Once opened, a multiple dose vial (MDV) is used within 28 days unless the manufacturer indicates a shorter expiration date and provided storage requirements have been met. The nurse on the floor initiating a new MDV records his/her initial along with the 28-day expiration date on the vial and discard after expiration. Discard vials with suspected or obvious contamination, container damage (e.g., cracked/broken vial, etc.) or illegible labeling. Return unopened expired vials to the Pharmacy Department.

EXCEPTIONS:

1) Tuberculin purified protein derivative, diluted (Aplisol, Parkdale Pharmaceuticals): Pharmacy staff records a 28-day expiration date on tuberculin vials at the time of dispensing. Place Tuberculin vials (open/unopened) in a destruction bin at time of expiration.

2) Insulin products: Insulin products dispensed to nursing areas may be stored under refrigeration or room temperature. Pharmacy staff records a 28-day expiration date on insulin vials/pens at the time of dispensing unless the manufacturer indicates a shorter expiration date. Place Insulin vials
B. Do Not Crush long acting medications prior to administering. (Abbreviations listed are examples of long-acting medications). For assistance, contact Pharmacy.

1) ER or XL – Extended Release
2) LA – Long Acting
3) CR – Controlled Release
4) SR – Sustained Release
5) EC – Enteric Coated

IV. SELF-ADMINISTRATION OF MEDICATIONS:
CFVHS defines self-administration of medications as “episodes of medication administration that include multi-dose containers (i.e. eye drops, cream, inhalers, tucks) where the patient or caregiver maintains control of the administrative device and can therefore deliberately or inadvertently alter the prescribed dosage.”

1) Examples of this may include, but are not limited to:
   a. Self-administration of eye drops where the patient is holding the vial.
   b. Self-administration of topical medication where the patient is holding the tube.
   c. Self-administration of inhalants where the patient is holding the multi-dose inhaler
2) Examples of this do not include
   a. The licensed nurse prepares a unit dose of medication(s) and hands it to the patient (or caregiver) for witnessed administration to the patient.
   b. The licensed respiratory therapist prepares a unit dose and administers via inhalation therapy or holds the medication and administers the medication while the patient holds the aerochamber.
3) Prior to self-administration, the following must occur:
   a. The licensed nurse educates the patient or caregiver who is involved in self-administration and documents the following in the patient’s medical interdisciplinary education record:
      - Medication name, type, and reason for use,
      - How to administer medication, including process (how to prepare for administration), time, frequency, route, and dose,
      - Anticipated actions and potential side effects of the medication administered, and
      - Monitoring the effects of the medication.
   b. The licensed nurse determines, and documents in the patient’s medical education record, that the patient or caregiver who administers the medication is competent at medication administration before allowing him or her to self-administer medications.
4) The licensed nurse provides the patient/caregiver the single medication dose/vial/tube/dropper et al… and documents self-administration in the medication administration record. Medication may not be left unsecured in the patient’s room. Medications are stored in a secure location, i.e. the Medication Room. Refer to Pharmacy “Medication Security” policy 30:38.
5) The patient or caregiver performing return demonstration during education are not considered self-administering medication and the return demonstration is to be documented in the patient’s interdisciplinary education record in an effort to validate patient or caregiver competency to administer the medication.

V. FIRST DOSE OF NEW MEDICATIONS:
A. Patient/Caregiver is provided education regarding new medications and ensures that questions are answered prior to administering first dose of new medication for patient. Education is documented in electronic medication administration record.
B. The first dose of a new medication to the patient is monitored by the nurse administering the medication.
C. Any adverse reaction to a new medication is reported to the ordering LIP and pharmacy; refer to Adverse Drug Reactions Pharmacy policy.
VI. HEMODIALYSIS:
   A. Medications are administered to dialysis patients prior to leaving the assigned unit for dialysis treatment unless ordered differently by the attending LIP. Medications may be administered outside standardized administration times for this purpose. Medications may also be administered outside standardized times for early morning discharge to SRRC or LTAC. This requires documentation of “Early Discharge” as acceptable reason in MAK.
   
   B. Any medications scheduled for administration with hemodialysis are sent with the patient to dialysis for administration and MAK documentation by the hemodialysis nurse.

VII. PEAK and TROUGH TESTS:
   A. When performing peak and trough tests, it is important the exact time of drug administration and the exact time of serum collection be recorded to ensure appropriate pharmacokinetic analysis of assay results.
   
   B. Trough serum levels are drawn one-half (1/2) hour prior to initiation of drug infusion. Gentamycin,
   
   C. Tobramycin and Amikacin Peak serum levels are drawn one-half (1/2) hour after completion of the infusion.
   
   D. Vancomycin Peak serum levels are drawn one (1) hour after the completion of the infusion.

VIII. TRANSCRIPTION OF MEDICATION ORDERS:
   A. MAR/MAK is utilized to list patient drug orders.
   
   B. Military time is utilized for administration times:
      0001, 0100, 0200, 0300, 0400, 0500, 0600, 0700, 0800, 0900, 1000, 1100, 1200, 1300, 1400, 1500, 1600,
      1700, 1800, 1900, 2000, 2100, 2200, 2300
   
   C. New medication orders are listed on the MAR/MAK.
   
   D. The Unit Secretary/Unit designated person scans the order to Pharmacy.
   
   E. The nurse verifies the order as entered by Pharmacy into MAK against the LIP order written in the patient’s medical record. If any of the Five Rights are inaccurate, then the nurse does not validate the order; instead, the nurse notifies pharmacy for correction. Upon pharmacy correction, the nurse rechecks the order in MAK against the LIP order written in the patient’s medical record prior to order verification.

IX. DOCUMENTATION:
   A. The nurse who administers the medication is responsible for documenting the administration on the MAR/flowsheet.
   
   B. In circumstances where another nurse has medicated a patient for the assigned nurse, the administering nurse is responsible for documenting on the MAR/MAK.
   
   C. Scheduled medications noted on the MAR/MAK as given do not need to be duplicated in the nurse’s progress notes. Use military time for administration time.
   
   D. PRN administration of medications for other than pain relief require an additional notation in the nurse’s progress notes identifying reason given, route of administration, including injection site (if not placed on MAR/MAK), transdermal site, etc., name of person administering, and patient’s response to medication.
   
   E. Content of documentation regarding administration of PRN medications administered for pain need to indicate date and time administered, pain location, pain score (rating of 0-10) (is to be noted both before
and after pain medication administration).

F. Charting includes for downtime MAR:

1) Diagonal slash through time with initials means: GIVEN
2) Circle means held/omitted, and document why on MAR or NOTES. (See Codes on MAR.)
3) An error has a single horizontal line drawn through it, date and signature.
4) MAR documentation includes dose administered if variable dose ordered; for example, if order reads Percocet one-two tabs PO pm for back or neck pain q 4-6 hours, documentation must show dose given, time and initials (i.e., Percocet one tab).

G. The nurse's signature consists of full name and title. Initials are used on MARs, and signature and initials are required in the signature box section.

X. PROPER HANDLING OF CONTROLLED SUBSTANCES:
A. Each licensed nurse receiving, dispensing and witnessing the destruction of controlled substances is responsible for proper control and documentation of controlled substances.
B. Destroy accidentally contaminated controlled substances on the Nursing unit with witness and documentation.
C. Contain I.V. narcotics within a locked container while infusing. In the Intensive Care Units, Versed and Ativan are administered via medication pump and are contained within a locked container.
D. An unused portion of a controlled substance (tubex, ampule, large volume container or partial tablet) is destroyed in the same manner as a contaminated controlled substance.

PROCEDURE:
A. Store controlled substances in a secure manner.
B. Document administration of a controlled substance on the MAR/MAK/Pain Management Flowsheet and the Controlled Substances Administration Record including:

1) Time of administration
2) Patient's full name
3) Room number or location
4) Name of medication
5) Dose administered
6) Signature of nurse administering the dose
7) Number of ampules/tablets/reservoirs remaining on hand
C. Document wastage of contaminated or unused portion of controlled substance on reverse side of Controlled Substance Administration Record, Pain Management Flowsheet, or Pyxis as follows:

1) Date and time of destruction
2) Name and type (dosage form) of medication destroyed
3) Quantity destroyed (large volume >1mL is to be measured)
4) Manner of destruction
5) Signature of two (2) licensed nurses or RN/Registered Radiology Technologist
D. Medication Reconciliation

1) Reconcile count on Controlled Substances Administration Record whenever nurses who administer narcotics go off duty.
2) Automated System:
A total narcotic inventory of the med station/Pyxis by Nursing personnel is required once per week.

3) When an automated system is not used:
   a. the count is done routinely at shift change by a nurse from each shift.
   b. report errors in the count to the Patient Care Manager and Pharmacy upon discovery. Every effort is expended to track down the source of the error and have the records corrected. **THE NURSES ARE NOT TO LEAVE UNTIL THE ERROR IS RECTIFIED.**
   c. The Pharmacy policy Controlled Substance Discrepancies is followed. A Controlled Substance Discrepancy form is available from the Pharmacy and is completed by the individual who discovered the problem. Send completed form to the Pharmacy. Inform the Patient Care Manager of the discrepancy for further follow-up. Completed reports are maintained by the Pharmacy as required by State and Federal Regulations.
   d. Ending balances from night shift are brought forward on a new sheet to begin at 0700.

E. Expired and unopened narcotics, including PCA medications, are returned to Pharmacy for wasting.

**XI. IV PUSH MEDICATIONS BY LPNs:**

THE FOLLOWING MEDICATIONS ARE APPROVED FOR IVP ADMINISTRATION BY LPNs.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aminophylline</td>
<td>Nubain</td>
</tr>
<tr>
<td>Ativan</td>
<td>Pecid</td>
</tr>
<tr>
<td>Benadryl</td>
<td>Phenergan (Central Line only)</td>
</tr>
<tr>
<td>Bumex</td>
<td>Phenobarbital</td>
</tr>
<tr>
<td>Compazine</td>
<td>Protonix</td>
</tr>
<tr>
<td>Decadron</td>
<td>Reglan</td>
</tr>
<tr>
<td>Demerol</td>
<td>Regular Insulin</td>
</tr>
<tr>
<td>Dextrose</td>
<td>Romazicon</td>
</tr>
<tr>
<td>Dilantin</td>
<td>Sodium Bicarbonate</td>
</tr>
<tr>
<td>Dilaudid</td>
<td>Solu-Cortef</td>
</tr>
<tr>
<td>Diltiazem (Cardizem)</td>
<td>Solu-Medrol</td>
</tr>
<tr>
<td>Heparin</td>
<td>Stadol</td>
</tr>
<tr>
<td>Heparin-lock</td>
<td>Talwin</td>
</tr>
<tr>
<td>Inapsine (Droperidol)</td>
<td>Toradol</td>
</tr>
<tr>
<td>Labetalol</td>
<td>Valium</td>
</tr>
<tr>
<td>Lanoxin</td>
<td>Venofer</td>
</tr>
<tr>
<td>Lasix</td>
<td>Verapamil</td>
</tr>
<tr>
<td>Morphine</td>
<td>Zofran</td>
</tr>
<tr>
<td>Narcan</td>
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During an emergency, if an ACLS nurse or LIP orders one of the following medications, the LPN administers the medication intravenously under the RN/LIP guidance.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenosine</td>
<td>Epinephrine</td>
</tr>
<tr>
<td>Amiodarone</td>
<td>Lidocaine</td>
</tr>
<tr>
<td>Atropine</td>
<td></td>
</tr>
</tbody>
</table>

**XII. REORDERING MEDICATION:**

A. Missing medications and bulk items are reordered by nursing messaging pharmacy in the MAK system or via telephone.

B. Do not “borrow” medications from one patient supply to give to another patient. The medication is charged to the patient at the time it is dispensed by the Pharmacy.
XIII. MEDICATION CONSENTS:

A. Investigational Drugs: An investigational drug may not be administered to a patient without a written informed consent form, signed by the patient.

B. Hepatitis B: Use “Immunization Generic” consent form. FormFast #0378

C. Antineoplastic Chemotherapeutics: Use “Consent to use F.D.A. Approved Chemotherapeutic Agents” FormFast #0169

Drugs used in the treatment of cancer.

Drugs utilized for neoplastic indication do not require consent but may necessitate special handling by hospital personnel due to potential cytotoxicity in preparing, handling, administration and spills. Examples include, but are not limited to:

1) Bleomycin via chest tubes
2) Methotrexate for use in ectopic pregnancies
3) 5FU (5-fluoracil) in ophthalmology
4) Other agents not classified as antineoplastics but requiring preparation and administration precautions such as Ganciclovir (Cytovene, Syntex).

D. Erythropoiesis-stimulating agents (ESAs) prescribed for cancer diagnosis requires:

1) The physician and patient to complete a “patient acknowledgement form.” The acknowledgement form confirms:
   a. That the physician is enrolled in the ESA APPRISE program
   b. There has been a discussion about the risks of the ESA between the physician and the patient
   c. The patient has received and been counseled with the appropriate ESA medication guide prior to each new course of therapy.
2) Nursing faxes this form to pharmacy prior to the medication being dispensed.
3) The acknowledgement form is placed in patient’s medical record under physician orders tab.
4) Nursing provides patient/caregiver with a “medication guide” with the first dose and documents in the MAK or pyxis.

E. Erythropoiesis-stimulating agents (ESAs) prescribed for non-cancer diagnosis requires:

1) Nursing provides patient/caregiver with a “medication guide” with the first dose and documents in the MAK or pyxis.

** See next page for “Medication Administration & Labeling Inpatient and Non-Procedural Areas” Diagram
Remove medication vial from Pyxis.

Is this a controlled substance requiring wastage?

YES

Draw up all medications in medication room

Waste in sink with witness

Cosign waste in Pyxis.

Label syringe with medication label. Include name and strength

Draw up all medications at patient bedside

Once medications are drawn up, labeling not required if administered immediately

NO

Is this a high alert medication requiring 2 licensed staff?

YES

Contact another licensed staff member to complete the next steps

NO

Go to patient room/stretcher

Scan your badge & medication vial to verify 4 of 5 Rights

Identify patient with the 2 Patient Identifiers

Scan patient, verifying 5th Right

Teach patient about medications

Administer medication within appropriate time frame

Complete documentation in MAK/MAR
Dosage and Solution Problems

1. A 78 kg adult weighs how many pounds? _______________________________

2. How many mL are required to give 10 mg of Morphine Sulfate subq from a 10-mL vial of Morphine Sulfate labeled 15 mg/mL? ______________________________

3. How many mLs are needed to give 1 gram of a medication p.o. if the liquid preparation is labeled “250 mg/5mL?” ______________________________

4. The physician ordered 0.5 mg digoxin, and we have 0.25 mg tablets on hand. How many tablets should be given? ______________________________

5. The doctor has ordered 60 mEq of Potassium Chloride to be given intraoperatively. The drug comes in liquid form and the vial is labeled “40 mEq/20 mL.” How many mL should be added to a liter bag of IV fluids? __________________

6. You are to give sodium methicillin to a hospitalized patient with a moderate infection. The ordered dosage is 1 gram I.M. q 6 hr. You have on hand a vial labeled “Sodium Methicillin 4 G – inject 5.7 mL sterile water to yield 8 mL of solution. Reconstituted solution is stable for 4 days under refrigeration.” How much must the nurse draw up for one dose of one gram? __________________

7. Digoxin is used in a pediatric dose of 0.01 mg/kg every 12 hr. It is available in 2 mL ampules containing 0.5 mg. A 66-pound child would require how many mL of the above solution in 48 hours? __________________________________

8. Give Disodium Carbenicillin q 6 hr IM to a child weighing 33 pounds. The dosage for this drug is 100 mg/kg/day. Determine the appropriate dosage that should be given to a child each time the drug is given? _____________________________

9. The doctor has ordered 15,000 USP Units of Heparin. The vial on hand contains 20,000 units/mL. How many mL is a single dose? __________________________

10. A 60-pound pediatric patient is hospitalized with a respiratory tract infection. The physician has ordered 500 mg of ampicillin trihydrate orally q 6 hr. The bottle is labeled “Ampicillin Trihydrate 10 grams-add 130 mL of water to yield 200 mL of suspension.” How many mL of the suspension must the nurse pour to provide one dose of 500mg? ______________________________

11. Dilaudid comes in ampules of 0.001 grams/mL In order to give your patient 2 mg of Dilaudid, how many mL must you administer? ______________________________

12. Colace 200 mg is ordered for your patient. You have available an oral liquid labeled: Colace 0.05-g/5 mL. How many mL will you give the patient? __________
13. The doctor ordered 0.125 mg of digoxin by IV injection. On hand is 0.5 mg/2mL How many mL will you draw up for the injection? _________________________

14. The doctor ordered Neboin 20 mg IM q 8 hr. The drug is available 80 mg/2mL How much will you draw up for this injection? ___________________________

15. As a preoperative medication, the patient is to receive 40 mg of hydroxyzone (Vistaril®) IM. The drug is available 100 mg/2mL. How many mL will you draw up to administer this injection? ______________________________

16. On hand is a vial of sterile powder labeled: Omnipen-500 mg. The directions say to add 1.8 mL of sterile diluent to provide a solution containing 250 mg/mL of the drug. The physician ordered 375 mg for his patient. How many mL will you draw up to give this dosage? ______________________________

17. Povan is to be given for pinworms: 5mg/kg of body weight. The patient weighs 30 kg. Form available: Oral suspension with 50 mg/5mL. How much should be given per dose? _______________________________________

18. Drug Order: Penicillin G potassium 500,000 Units q 6 hr. The drug is available in a vial containing 1,000,000 Units of powder. If powder is dissolved in 3.6 mL of sterile water, there will be 250,000 U/mL. How many mL should be given per dose? _______________________________________

19. A patient is to receive nine tablets containing 500 mg each. How many grams would the patient receive? _______________________________________

20. Mrs. J. is a 65-year-old patient who is comatose following a stroke. She is receiving her medications and nutrition via an NG tube. The doctor has ordered "Procardia XL 30 mg once daily." The Pharmacy has sent Procardia XL 30mg tablets to the unit. How would you administer this medication? ___________________
IV Problems

1. The doctor ordered 20,000 units of Heparin to be placed in 1000 cc of D₅W. Infuse at the rate of 600 units each hour. The IV pump should be set to run at _______ mL/hr.

2. The order was written to add one (1) gram of Amminophyllin to 1000 mL of D₅W to infuse at the rate of 40 mL per hour. The patient will receive ____ mg of the drug each hour.

3. The doctor ordered 500 mg of Morphine to be placed in 1000 mL of D₅W. The order was written to infuse at the rate of 37 mg per hour. The hourly rate should be set to infuse at __________ mL per hour.

4. The patient has an infusion of morphine 100 mg in 1000 mL of Dextrose/water 5%. The infusion rate is 40 mL per hour. How many milligrams of morphine will the patient receive each hour? __________

5. The doctor ordered 40,000 units of heparin to be placed in 1000 mL of D₅W to be given at 40 mL per hour.
   i. How many units of Heparin in 1 mL of solution? _______________
   ii. How many units of Heparin will the patient be receiving each hour? ____________________
   iii. How many hours will it take to infuse the total amount? ________

6. Order: 10,000 Units of Heparin in 500 mL of D₅W to be infused at 800 Units per hour.
   i. How many units of Heparin in 1 mL of the solution? ____________
   ii. How many mL per hour will be infused? _____________________
   iii. How long to infuse the entire solution? ______________________

7. In IV problem #6, the order was written at 8 am. At 1:00 PM, the doctor writes the following change in the 8 am order: Give the Heparin solution at a rate of 75 mL per hour.
   i. How long will it take to infuse the remaining solution? ________
   ii. How many units of heparin will the patient receive each hour? ___

8. The physician order cephalothin sodium (Keflin®) 6 grams to be diluted in 500 mL of D₅W. You are to deliver 125 mL IV every 6 hrs. Calculate the number of grams to be given in each dose. ______________________
Additional Need-to-Know Information

REVIEW THE ACTION OF THESE DRUG CLASSIFICATIONS:

- Miotic
- Mydriatic
- Analgesic
- Tranquilizer
- Antiemetic
- Antidiarrheal
- Mucolytic Agent
- Antianginal
- Antihypertensive
- Antihypotensive
- Antipyretic
- Cardiotonic
- Antidepressant
- Antiarrhythmic

Remember that 1 kilogram = 2.2 pounds

To change pounds to kilograms divide by 2.2
A child weighs 55 pounds.
How many kilograms does he weigh?
Solution: 55 divided by 2.2 = 25 kilograms

To change kilograms to pounds multiply by 2.2
A woman weighs 55 kilograms
How many pounds does she weigh?
Solution: 55 kg multiplied by 2.2 = 121 pounds
Answer Key for Dosages and Solution Problems:

1. 171.6 lbs
2. 0.66 mL
3. 20 mL
4. 2 Tabs
5. 30 mL
6. 2 mL
7. 4.8 mL
8. 375 mg
9. 0.75 mL
10. 10 mL
11. 2 mL
12. 20 mL
13. 0.5 mL
14. 0.5 mL
15. 0.8 mL
16. 1.5 mL
17. 15 mL
18. 2 mL
19. 4.5 grams
20. You cannot crush extended release tablets or capsules to place in an NG tube. You would need to call the Doctor to get a clarification of the order.

Answer Key for IV Problems:

1. 30
2. 40 mg
3. 74 mL
4. 4
5. 40 units/mL
   1600 units
   25 hours
6. 20 units/mL
   40mL/hour
   12.5 hours
7. 4 hours
   1500 units
8. 1.5 g
Dosage and Solutions Problems Solved

1. \[78 \text{ kg} = 171.6\]
   \[78 \times 2.2 = 171.6\]

2. \[\frac{15}{1} = \frac{10}{x}\]
   \[15x = 10\]
   \[x = 0.66 \text{ mL}\]

3. \[\frac{250}{5} = \frac{1000}{x}\]
   \[250x = 5000\]
   \[x = 20 \text{ mL}\]

4. \[0.5 = 2 \text{ tabs}\]
   \[0.25\]

5. \[40 = 60\]
   \[20 \times\]

6. \[4 = 1\]
   \[8 \times\]
   \[4x = 8\]
   \[x = 2 \text{ mL}\]

7. 66 lbs = 30 kg
   \[0.01 \text{ mg} \times 30 \text{ kg} = 0.3 \text{ mg q 12 hrs}\]
   \[0.5 \text{ mg} = 0.3 \text{ mg}\]
   \[2 \text{ mL} \times\]
   \[0.5x = 0.6\]
   \[0.5 \times 0.6\]
   \[x = 1.2 \text{ mg} \times 4 \text{ doses} = 4.8 \text{ mL}\]

8. 33 lbs = 15 kg
   \[2.2\]
   \[100 \times 15 = \frac{1500}{4} = 375 \text{ mg}\]

9. \[\frac{20000}{1} = \frac{15000}{x}\]
   \[20000x = 15000\]
   \[20000 \times 20000\]
   \[x = 0.75 \text{ mL}\]

10. 10 g = 10000 mg
    \[10000 \times x = 10000\]
    \[10000 \times 10000\]
    \[x = 10 \text{ mL}\]

11. 0.001 g x 1000 = 1 mg
    \[\frac{1 \text{ mg}}{1 \text{ mL}} \times x\]
    \[x = 2 \text{ mL}\]

12. 0.05 g = 50 mg
    \[\frac{50 \text{ mg}}{200 \text{ mg}} \times\]
    \[50 \times 1000\]
    \[x = 20 \text{ mL}\]

13. \[0.5 \text{ mg} = 0.125\]
    \[\frac{2}{x}\]
    \[0.5 \times 0.25\]
    \[0.5 \times 0.5\]
    \[x = 0.5 \text{ mL}\]

14. \[\frac{80 \text{ mg}}{20 \text{ mg}} \times\]
    \[80 \times 20 \text{ mg}\]
    \[80 \times 80\]
    \[x = 0.5 \text{ mg}\]

15. \[\frac{100}{2} = \frac{40}{x}\]
    \[100 \times x = 80\]
    \[100 \times 100\]
    \[x = 0.8 \text{ mL}\]

16. \[\frac{250 \text{ mg}}{375 \text{ mg}} \times\]
    \[250 \times 375\]
    \[250 \times 250\]
    \[x = 1.5 \text{ mLs}\]

17. 5 mg = 150 mg
    \[30 \text{ kg}\]
    \[50 \text{ mg} = 150 \text{ mg}\]
    \[5 \times\]
    \[50 \times 750\]
    \[x = 15 \text{ mg}\]

18. \[\frac{250000 \text{ units}}{500000 \text{ units}} \times\]
    \[250000 \times x = 500000\]
    \[\frac{250000}{250000}\]
    \[x = 2\]

19. 9 \times 500 = 4500 mg
    \[\frac{4500}{4.5 \text{ g}}\]
**IV Problems Solved**

1. The doctor ordered 20,000 units of Heparin to be placed in 1000 mL of D\(_5\)W. Infuse at the rate of 600 units each hour. The IV pump should be set to run at 30 mL/hr.

\[
\frac{20,000}{1,000} = \frac{600}{x} \\
200,000x = 600,000 \\
\frac{20,000 \times x}{20,000} = \frac{600,000}{20,000} \\
x = \frac{600,000}{20,000} = 30
\]

2. The order was written to add one (1) gram of aminophyllin to 1000 mL of D\(_5\)W to infuse at the rate of 40 mL per hour. The patient will receive 40 mg of the drug each hour.

\[
\frac{1000 \ mg \ (1 \ gram)}{1000 \ mL} = \frac{x}{40 \ mL} \\
1000x = 40,000 \\
\frac{1000x}{1000} = \frac{40,000}{1000} \\
x = 40 \ mg
\]

3. The doctor ordered 500 mg of morphine to be placed in 1000 mL D\(_5\)W. The order was written to infuse at the rate of 37 mg per hour. The hourly rate should be set to infuse at 74 mL per hour.

\[
\frac{500 \ mg}{1000 \ mL} = \frac{37 \ mg}{x \ mL} \\
500x = 37,000 \\
\frac{500x}{500} = \frac{37,000}{500} \\
x = 74 \ mLs
\]

4. The patient has an infusion of morphine 100 mg in 1000 mL of Dextrose/Water 5%. The infusion rate is 40 mL per hour. How many milligrams of morphine will the patient receive each hour? 4 mg/hour

\[
\frac{100 \ mg}{1000 \ mL} = \frac{x}{40 \ mL} \\
1000x = 4000 \\
\frac{1000x}{1000} = \frac{4000}{1000} \\
x = 4
\]

5. The doctor ordered 40,000 units of heparin to be placed in 1000 mL of D\(_5\)W to be given at 40 mL per hour.

i. How many units of heparin in 1 mL of solution of solution? 40 units/1mL

\[
\frac{40,000}{1000} = 40 \\
\frac{40}{1000} = 40 \ units
\]

ii. How many units of heparin will the patient receive each hour? 1600 units/hour.

\[
\frac{40,000}{1000} = \frac{x}{40} \quad \text{or} \quad \frac{40}{40cc} = 1 \\
1000x = 1,600,000 \\
\frac{1000x}{1000} = \frac{1,600,000}{1000} \\
x = 1600 \ units
\]

iii. How many hours will it take to infuse the total amount? 25 hours

\[
\frac{1000}{40} = 25
\]
6. Order: 10,000 units of heparin in 500 mL of D₅W to be infused at 800 units per hour.
   i. How many units of heparin in 1 mL of the solution? 20 units/1mL

\[
\frac{10,000 \text{ units}}{500 \text{ mL}} = X
\]

\[
500X = 10,000
\]

\[
X = 20
\]

   ii. How many mL per hour will be infused? 40 mL/hour

\[
\frac{10,000 \text{ units}}{500 \text{ mL}} = \frac{800 \text{ units}}{X \text{ mL}}
\]

\[
10,000X = 400,000
\]

\[
X = 40
\]

   iii. How long to infuse the entire solution? 12.5 hours

\[
\frac{500 \text{ mL}}{40 \text{ mL/hr}} = 12.5 \text{ hours}
\]

7. In IV problem #6, the order was written at 8 am.
At 1:00 pm, the doctor writes the following changes in the 8 am order: Give the heparin solution at a rate of 75 mL per hour.

   i. How long will it take to infuse the remaining solution? 4 hours

Fluid has run at 40 mL/hr for 5 hours = 200 mL infused. 300 mL of fluid remaining to run at 75 mL per hour.

\[
\frac{300}{75} = 4 \text{ hrs}
\]

   ii. How many units of heparin will the patient be receiving each hour? 1500 units

\[
\frac{20 \text{ units}}{1} = \frac{X}{75}
\]

\[
X = 1500 \text{ units}
\]

8. The physician orders cephalothin sodium (Keflin®) 6 grams to be diluted in 500 mL of D₅W. You are to deliver 125 mL IV q 6 hrs. Calculate the number of grams to be given in each dose. 1.5 grams

\[
\frac{6 \text{ grams}}{500 \text{ mL}} = \frac{X}{125 \text{ mL}}
\]

\[
500X = 750
\]

\[
X = 1.5
\]
This booklet is designed to help nurses learn more about basal-bolus insulin. Examples are included to help nurses learn more about calculating insulin doses.

**Fast Track to Basal-Bolus Information**

- Introduction to Basal-Bolus Insulin..............................................................2
- What are the Benefits of Basal-Bolus Insulin?............................................2
- What are Lantus and Levemir? .................................................................3
- Why is Rapid-Acting Insulin also used In a Basal-Bolus Plan? ............3
- Excerpt of CFVHS Orders..........................................................................4
- General Guidelines ....................................................................................4-5
- Dietary Information....................................................................................5
- Check Your Understanding.......................................................................5
- MAK Screen Shots....................................................................................6

Note: At CFVHS, we primarily use Lantus™ or Levemir™ as the background insulin and Novolog™ as the rapid-acting insulin.
Introduction to Basal-Bolus Insulin

To understand basal-bolus insulin, it is helpful to first understand what happens in the body when a person does not have diabetes.

Insulin is normally produced by the pancreas and is present in the body 24 hours a day, every day. There are two major ways that insulin is provided by the pancreas: basal and bolus.

- Basal-Bolus insulin is continuous, background insulin that the body needs to keep blood sugar in control when no food is eaten. Basal-Bolus insulin is working even during hours of sleep.
- Bolus insulin is extra insulin that is released as needed to match food intake.

When a person does not have diabetes, the pancreas automatically produces the exact amount of basal and bolus insulin that is needed. The amount of insulin is adjusted for changes in activity level or food and during times of stress and illness. Because the basal-bolus system works so well when a person does not have diabetes, food can be eaten at any time and in any amount and the blood sugar will still stay within normal range!

What are the Benefits of Basal-Bolus Insulin?

One of the goals of using basal-bolus insulin in diabetes is to keep blood sugars in a healthy range as often as possible. Basal-Bolus-bolus insulin, combined with strong knowledge and skills, can improve blood glucose control, which has immediate and long-term health benefits.

To benefit from a basal-bolus approach, diabetes management requires:

- Basal insulin every day and rapid – acting insulin for each meal (and some snacks if ordered). This usually means administering insulin at least 4 times a day.
- Blood sugars are checked at least 4 times a day (as ordered by the LIP).
- Blood sugar levels and daily injections are recorded and reviewed to make informed decisions about insulin dosing.

**Basal–Bolus Plan at CFVHS**
- Basal (long-acting): Lantus or Levemir
- Bolus (mealtime): Rapid-acting Novolog
- Correction (supplemental): Rapid-acting Novolog

(See excerpt of the orders on below)
**What are Lantus and Levemir?**

Lantus™ (also known as insulin glargine) and Levemir™ (also known as insulin detemir) are long-lasting ‘basal’ insulins. Basal-Bolus insulin describes the slow, steady release of insulin that is needed even when no food is eaten. Another name for basal insulin is ‘background’ insulin.

Lantus and Levemir start to work in 60-90 minutes and can last for up to 20-24 hours. Both insulins have quite a flat, steady action throughout the day and night. Because of their flat action, they are not effective in controlling blood sugars after eating. Patients who use Lantus or Levemir also need rapid-acting insulin when they eat. (See excerpt of CFVHS Orders below)

**Important Information about Lantus and Levemir**

- Do not mix Lantus or Levemir in a syringe with any other insulin. Mixing will change the insulin properties and they will not work properly.
- Lantus and Levemir may not last 24 hours in all patients. Some patients may need them twice a day. This is common when Levemir is used.
- Administer basal insulin (Lantus or Levemir) at the same time each day. A common time to give basal insulin once a day is at bedtime. Basal-Bolus insulin that is given twice a day if often given at breakfast and at dinner or bedtime.
- Do not inject Lantus or Levemir into a muscle. To decrease the possibility of injecting into a muscle: 1) gently pinch up a small hill of fat at the injection site 2) avoid muscular areas where there is not much fat.
- A small number of patients may feel a burning sensation where they inject Lantus.
- Lantus or Levemir is needed even if no food is eaten.

**Why is Rapid-Acting Insulin Also Used in a Basal-Bolus-Bolus Plan?**

Rapid-acting insulin is used as the ‘bolus’ part of a basal-bolus plan. It is given before carbohydrate-containing meals (and snacks if ordered by LIP) to keep blood sugars from rising too high after eating.

Like the pancreas, which produces extra insulin to match food that is eaten, boluses of rapid-acting (Novolog) for food. In the future, we will learn more about carbohydrate counting and Insulin-to-Carbohydrate Ratios as tools for matching insulin and food in a basal-bolus plan.

Rapid-acting insulin can also be given to quickly lower high blood sugars. Rapid-acting insulin starts to work in about 15 minutes and peaks in about 90 minutes. Giving the extra rapid-acting insulin for high blood sugars can shorten the amount of time that the blood sugar is high.

Rapid-acting insulin only lasts for about 3-4 hours. Because of its short action, it must be used along with a longer-acting, background (basal) insulin.
Excerpt of CFVHS Basal-Bolus Orders

**Basal (Long Acting) Insulin** (typically 50% of the TDD, and typically given at every HS)

- **SQ Lantus** [ ] units [ ] Q HS [ ] Q AM [ ] BID
- **SQ Levemir** [ ] units [ ] Q HS [ ] Q AM [ ] BID

**Bolus (Mealtime)** SQ Novolog Insulin (typically 50% of the TDD, reduce if pt is not expected to eat a full meal)

Breakfast [ ] units Lunch [ ] units Supper [ ] units

---

**Correction (Supplemental) Insulin Scale – LIP Select one of the following**

<table>
<thead>
<tr>
<th>BG Range</th>
<th>Less than 65 kg or hx of ESRD</th>
<th>65-100 kg</th>
<th>Greater than 100 kg or hx of resistance</th>
<th>Custom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 70</td>
<td>Hold correction dose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71-90</td>
<td>Minus 1 unit</td>
<td>Minus 1 unit</td>
<td>Minus 2 units</td>
<td></td>
</tr>
<tr>
<td>91-150</td>
<td>0 units</td>
<td>0 units</td>
<td>0 units</td>
<td></td>
</tr>
<tr>
<td>151 – 200</td>
<td>1 unit</td>
<td>2 units</td>
<td>3 units</td>
<td></td>
</tr>
<tr>
<td>201 - 250</td>
<td>2 units</td>
<td>4 units</td>
<td>6 units</td>
<td></td>
</tr>
<tr>
<td>251 – 300</td>
<td>3 units</td>
<td>6 units</td>
<td>9 units</td>
<td></td>
</tr>
<tr>
<td>301 – 350</td>
<td>4 units</td>
<td>8 units</td>
<td>12 units</td>
<td></td>
</tr>
<tr>
<td>351 – 400</td>
<td>5 units</td>
<td>10 units</td>
<td>15 units</td>
<td></td>
</tr>
</tbody>
</table>

Greater than 400 Notify LIP for orders

---

**General Guidelines**

- CFVHS target range is greater than 70 and less than 180 mg/dL.
- If blood sugars are not in target range, consider reasons.
- Look for patterns (trends in blood sugars over about 3 days)
- LIPs will adjust basal or mealtime dosages based on patterns.
- LIPs will adjust correction doses to quickly bring down high blood sugars.
**Timeliness of Doses:**

- **Perform** fingerstick blood glucose (FSBS) or obtain blood glucose specimen from central/arterial line prior (goal is within 60 minutes) to scheduled meal delivery.
- **Do not use** lab values from metabolic panels because too much time will elapse between when the specimen is obtained and the administration of the insulin.
- **Administer** Novolog immediately before a meal (goal is within 15 min).
- **Document** using ‘early/late reason’ option in MAK if administration time is different than tray delivery time. (See Screen shot). This option is an acceptable early/late admin reason.

**Omitted Doses:**

- Administer insulin as ordered.
- Notify the LIP if there are concerns about administration of the dose.
- Notify the LIP if doses are not administered, including pts going to OR.
- Document the LIP notification in the nurse’s notes, and any nursing interventions.
- Use the SBARR to improve communication between shifts and with the LIP.

**Correct Doses:**

- **Calculate** the dose.
- **Round** to the nearest whole unit:
  - 0.1 – 0.4 = round down to whole unit
  - 0.5 – 0.9 round up to whole unit
- **Verify** blood sugar POC values in ValleyLink/EMSTAT prior to administration. (See Screen Shot)
- **Perform** dose check: Two licensed nurses, one being a RN, verify the order (MAR/MAK/EMSTAT), medication and dose.

**Dietary Information:**

- Three meals reflect all the calories the patient can have in a day
- Only give water and diet drinks to pt., unless pt. does not eat all of diet
- Replace one carb choice for another:
  - 15 Gms CHO = one carb choice (such as 4 oz. of juice is one carb choice, and should raise the BS up by 40 mg/dL)

**Check Your Understanding**

The patient’s orders are as follows:

<table>
<thead>
<tr>
<th>Basal SQ Lantus</th>
<th>10 units q HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolus (mealtime) insulin:</td>
<td></td>
</tr>
<tr>
<td>Breakfast</td>
<td>5 units SQ</td>
</tr>
<tr>
<td>Lunch</td>
<td>5 units SQ</td>
</tr>
<tr>
<td>Supper</td>
<td>5 units</td>
</tr>
</tbody>
</table>

Use the Correction Scale for 65-100 kg to calculate the **total dose** of Novolog to be administered.

1. The FSBS before breakfast is 230. How many units of Novolog are to be administered?
   - A. 5 units
   - B. 4 units
   - C. 9 units
   - D. 11 units

2. The FSBS before supper is 140. How many units of Novolog are to be administered?
   - a. 5 units
   - b. 10 units
   - c. 17 units
   - d. 9 units

3. The FSBS is before supper is 90. How many units of Novolog are to be administered?
   - a. 5 units
   - b. 0 units
   - c. 4 units
   - d. 3 units
Answers:

**Question #1:** Administer 9 units. Bolus (5 units) + correction (4 units).

**Question #2:** Administer 5 units. Bolus (5 units) + correction (0 units).

**Question #3:** Administer 4 units. Bolus (5 units) + correction (minus 1 unit).

**MAK Screen Shots**

**Early/Late Administration due to Meal Tray Delivery**

- Insulin order will be pink/peach.
- Message will appear stating medication is late.
- Click OK.
- Early/Late Reason box will appear
- Click drop down arrow
- Select “Admin with Meals”. Do not free text.
- Click ‘Accept’

- Enter the amount of insulin dose
- Click “accept”