

# Pharmacist-Managed Pharmacokinetics Service



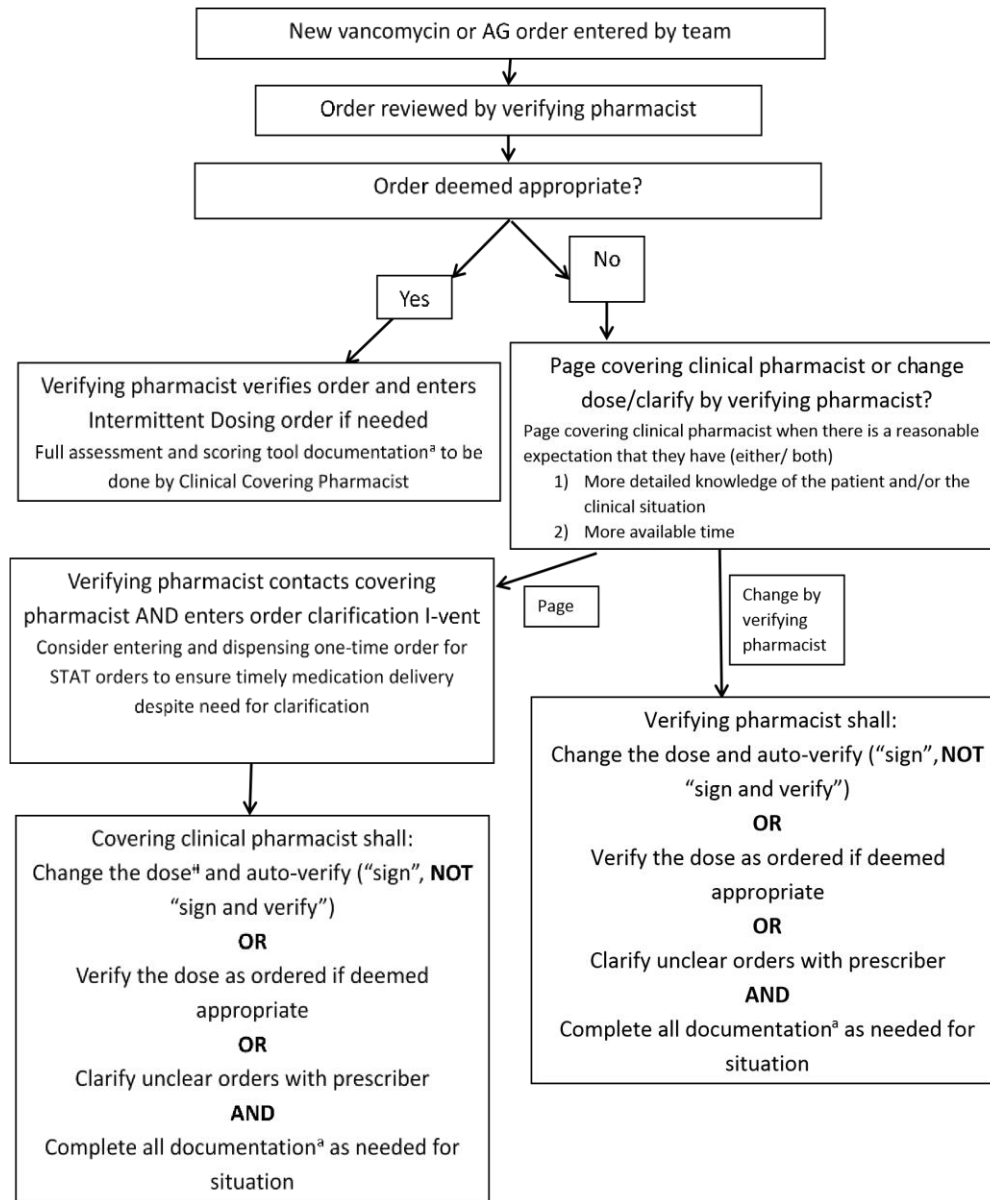
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*The recommendations in this guide are meant to serve as treatment guidelines for use at Michigan Medicine facilities. If you are an individual experiencing a medical emergency, call 911 immediately. These guidelines should not replace a provider's professional medical advice based on clinical judgment, or be used in lieu of an Infectious Diseases consultation when necessary. As a result of ongoing research, practice guidelines may from time to time change. The authors of these guidelines have made all attempts to ensure the accuracy based on current information, however, due to ongoing research, users of these guidelines are strongly encouraged to confirm the information contained within them through an independent source.*

*If obtained from a source other than [med.umich.edu/asp](http://med.umich.edu/asp), please visit the webpage for the most up-to-date document."*

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# New Orders Workflow Cont'd- Covering Clinical Pharmacist Responsibility for Verification of Pharmacist-Managed Orders

- When assessing a new therapy (based on a “red dot” or “pencil and paper” icon on the scoring tool)
  - If the dose is appropriate as ordered, check to see if the order is already verified or not. If not yet verified, verify the order
    - Indicator that the order is NOT verified is denoted next to the medication name in the scoring tool report

**Summary**  
Willow-Mba, Ahmed MRN-100022215 (CSN-1000402442) (62 y.o. M) (Adm: 12/22/16) UH 4DNI-4816-01

**Kinetics Monitoring : 10**

Kinetics: 10 points (Up 10 points since last review) - [Last updated: 06/14/17 1448]

Patient received a score of 10 points: 5 points for each aminoglycoside or vancomycin order. 10 points if any aminoglycoside/vancomycin drug levels resulted in the last 12 hours & 15 points if most recent vancomycin trough > 20 mcg/mL, gent/tobra trough >= 2 mcg/mL, or amikacin trough >= 10 mcg/mL.

Start	Dose/Rate	Route	Frequency	Ordered	Hide
06/12/17 1730	tobramycin (NEBCIN) 50 mg in sodium chloride 0.9 % 11.25 mL IVPB 1 mg/kg per DOSE × 50 kg (Dosing Weight) 222.5 mL/hr over 30 Minutes	Intravenous	EVERY 12 HOURS	06/12/17 1653	Stop
06/13/17 1700	amikacin (AMIKIN) 250 mg in dextrose 5% 111 mL IVPB 5 mg/kg per DOSE × 50 kg (Dosing Weight) 222 mL/hr over 30 Minutes	Intravenous	EVERY 8 HOURS	06/13/17 1617	Stop

Recent Drug Levels  
No lab values to display.

Antibiotic Monitoring

- Box in scoring tool is highlighted light blue
- If you change the order, the new order will auto-verify (sign, do not “sign and verify”)

# New Orders Workflow Cont'd-

## Documentation Requirements (slide 3 footnote a)

- In patient list, “PK Review” column, new orders will appear as a “red dot”
  - Pharmacist must document the following in the sticky note: 1) indication for therapy and 2) goal for therapy. If duration of therapy is known, inclusion of this information is recommended.
  - DAILY documentation is also required in the “Kinetics Monitoring” field. Then, mark as reviewed—the ‘red dot’ will turn to a ‘green checkmark’.
  - Note: for vancomycin; documentation in “Restricted Abx” section additionally required
- Ensure that appropriate vancomycin and/or aminoglycoside serum concentrations are ordered (lab order)
  - If already ordered, assess ordered levels for appropriateness (if changes needed, enter appropriate order)
  - If not already ordered, enter order as appropriate
- Initiate Rx Follow-Up or Day Shift Follow-up iVent, as appropriate
- Documentation of initial PK care plan viewable to multidisciplinary team required:
  - Whenever the pharmacist makes a recommendation for changes in therapy (e.g., dose change on initiation of therapy, dose changes based on serum concentrations, “PRN” dosing)
  - When the pharmacist makes a recommendation to clarify an inaccurate level (e.g., trough drawn at incorrect time)
  - When the pharmacist believes a clarification or other documentation is needed
  - NOTE: For patients on pediatric service lines, ALL levels must be documented in the patient chart
  - NOTE: Communication with providers (in person, via phone or via paging system) is expected when clarification is required

**Pharmacist-Managed PK Dosing and Monitoring  
Assessment of New Serum Concentrations, Dose Adjustments, and  
Documentation**

*\*Complete by end of shift and/or sign out to next shift\*  
Must be completed within 24 hours*

Vanc/AG Serum Concentration Review, Dose  
Adjustment, Documentation and Rx Follow-Up

**Assessment of Serum Concentrations, Dose Adjustments, Documentation, and Follow-Up**

1. In Clinical Scoring Tool, daily documentation is required in the "Kinetics Monitoring" field  
*\*Note: New levels will stay on the scoring tool for 12 hours. Critical levels will stay on the scoring tool for 24 hours or until a new level that is no longer critical comes back.*
2. Assess serum concentration and revise PK Care Plan, as appropriate
  - a. If dose change is necessary, discontinue currently ordered dose and write order for appropriate new dose
3. Documentation to multidisciplinary team is required using approved PK template for new levels meeting these indications:
  - a. Whenever the pharmacist makes a recommendation for changes in therapy (e.g., dose change on initiation of therapy, dose changes based on serum concentrations, "PRN" dosing)
  - b. When the pharmacist makes a recommendation to clarify an inaccurate level (e.g., trough drawn at incorrect time)
    - i. Note type should be "Medication Management". F2 will bring up "Kinetics Note Templates" option, which will guide you to appropriate template
    - ii. Remember that documentation is also required (DAILY) in the Clinical Scoring Tool, which can either be the copied note or a shortened version.
    - iii. When the pharmacist believes a clarification or other documentation is needed
    - iv. NOTE: For patients on pediatric service lines, ALL levels must be documented in the patient chart
4. Ensure that appropriate follow-up vancomycin and/or aminoglycoside serum concentrations are ordered
  - a. If already ordered, assess ordered levels for appropriateness (if changes needed, enter appropriate order)
  - b. If not already ordered, enter order as appropriate
5. If previous Rx Follow-Up or Day Shift Follow-Up iVent started and the intervention has been completed (above), close iVent
6. Initiate new Rx Follow-Up or Day Shift Follow-Up iVent, as appropriate, for future follow up

\*NOTE: Communication with providers (in person, via phone or via paging system) is expected when clarification is required.

# Documentation Expectations- Review

- When do you need to write a note in the EMR (*medication management* note)?
  - Whenever the pharmacist makes a recommendation for changes in therapy (e.g., dose change on initiation of therapy, dose changes based on serum concentrations, “PRN” dosing)
  - When the pharmacist makes a recommendation to clarify an inaccurate level (e.g., level drawn at incorrect time)
  - When the pharmacist believes a clarification or other documentation is needed
  - NOTE: For pediatric patients, ALL levels must be documented in the patient chart

**Per UMHHC Policy 07-01-019**

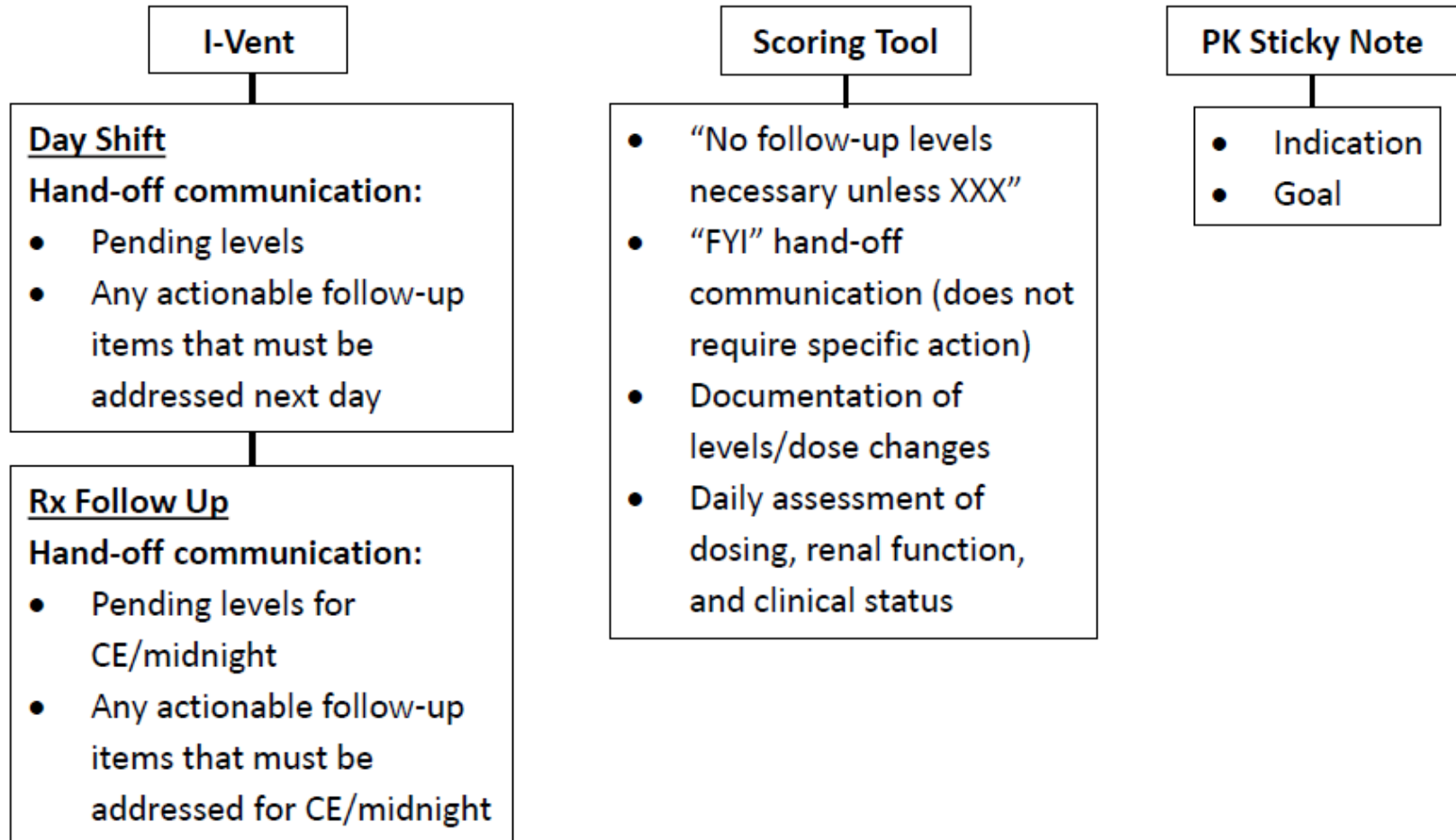
# Documentation Expectations

- Examples for when to write notes in the EMR:
  - Patient receiving PRN dosing because on renal replacement therapy → write a note every time a dose is entered or level ordered *and* needs clarification
  - “Dosing by levels” due to poor renal function → write a note every time a dose is entered or level ordered *and* needs clarification
  - Level comes back and you recommend dose adjustment to team → write a note reflecting recommendation
  - Medical team documents “pharmacist managing vancomycin in progress note” → if changes are made or clarification is needed, you are responsible for entering medication management note



# Documentation Expectations

- What about I-vent vs. scoring tool vs. PK sticky note?



# “Intermittent Dosing” Order

- Replaces “pharmacist to manage” order, which was frequently misunderstood.
- Purpose of placing the order is to indicate active therapy in a patient requiring “PRN dosing” so MiChart knows to fire for review every day
- Only pharmacists can order! So, pharmacists **MUST** be attuned to whether order needs to be placed.
  - The order instructs physicians to discontinue the order to let pharmacy know that the team does not want to continue therapy.

# “Intermittent Dosing” Order (Vancomycin Example)

**Orders** ? ↗

**Active** | Signed & Held | Home Meds | Cosign | Order History | TPN | Recurring Treatment

Sort by: Order Type  Go to: Scheduled

fluconazole (DIFLUCAN) 400 mg/200 mL IVPB 800 mg	800 mg, Intravenous, EVERY 24 HOURS Recommended INF time: 2 hrs First dose on Tue 8/14/18 at 1445	<input type="button" value="Modify"/> <input type="button" value="Discontinue"/>
furosemide (LASIX) oral solution 20 mg	20 mg, Oral, DAILY For Oral Use Only First dose on Sat 8/4/18 at 0600, Until Discontinued	<input type="button" value="Modify"/> <input type="button" value="Discontinue"/>
lisinopril (ZESTRIL) tablet 20 mg	20 mg, Oral, ONCE DAILY First dose on Fri 8/10/18 at 1115, Until Discontinued	<input type="button" value="Modify"/> <input type="button" value="Discontinue"/>
vancomycin intermittent dosing	Intravenous, See Admin Instructions, Starting Tue 8/28/18 at 0945, Until Discontinued - The patient is actively receiving non-scheduled vancomycin therapy (i.e. "dose by levels" for patients with AKI, on intermittent HD, etc.) - Discontinue this order if you do not want the patient to receive the medication any further.	<input type="button" value="Modify"/> <input type="button" value="Discontinue"/>

# “Intermittent Dosing” Order Physician Communication

- Vancomycin/Aminoglycoside orders require physicians to answer the following to enhance communication to pharmacy:
- Interpretation of possible order combinations by pharmacist:

The screenshot shows a medical order entry interface with the following fields and options:

- Is therapy intended to continue beyond one dose?**: Radio buttons for Yes, No, and Per Peri-operative prophylaxis guidelines.
- Dose:**: A search field with a magnifying glass icon and a dropdown menu with options: 500 mg, 750 mg, 1,000 mg, 1,250 mg, 1,500 mg, 1,750 mg, 2,000 mg.
- Route:**: A search field with a magnifying glass icon and a dropdown menu with the option: Intravenous.
- Frequency:**: A search field with a magnifying glass icon and a dropdown menu with options: Once, Q6H, Q8H, Q12H, Q24H.

- Yes, scheduled order – verify or change as appropriate
- No, scheduled order – clarify with prescriber
- Yes, once – verify and enter “Intermittent Dosing” order if appropriate for dosing by levels – or change to scheduled dosing if appropriate based on renal function (and write note)
- No, once – Verify and dispense single dose
- “Per Peri-operative prophylaxis guidelines” will be defaulted in perioperative order sets

# “Intermittent Dosing” Order Pharmacist Order Entry

- BPA in order verification activity (see screenshot next slide) will remind pharmacist that “Intermittent Dosing” order is needed if all 3 of the following conditions exist:
  - Order question is answered “Yes”
  - Frequency is “Once”
  - There is not an active “Intermittent Dosing” order
- If appropriate for dosing by levels (not appropriate for scheduled dosing), verifying pharmacist should enter order the “Intermittent Dosing” order
- If appropriate dosing unclear, verifying pharmacist may page clinical covering pharmacist per our pharmacist managed order clarification communication guidance ([link](#))

# “Intermittent Dosing” Order Verification Screen BPA

**Verify Orders - Order Details**

Order ID: 101287680

vancomycin in 0.9 % sodium chloride 1 g/200 mL IVPB 1,000 mg  
New (read-only)

Ordered by: Enell, Matthew Today 1258

**Dispensing Information**

Dispense from: UM UH CLEAN ROOM  
First doses: UM UH 6 FLOOR SATELLITE PHARMACY

Order dose:	<b>1,000 mg</b>	Route:	<b>Intravenous</b>	Frequency:	<b>ONCE</b>
Admin dose:	<b>1,000 mg (200 mL)</b>	Volume:	<b>200 mL</b>	# of doses:	<b>1</b>
		Calc volume:	<b>Yes</b>	1st dose:	<b>Today 1330</b>

Lab results:  
No Creatinine Clearance results found.

Order questions:  
Please select an indication:

Is therapy intended to continue beyond one dose?  Yes

Product-specific admin instructions:  
Recommended INF time: 2 hours

Dispensable: **vancomycin 1 g in 200 mL 0.9 % sodium chloride**

Products to dispense	Order dose	Admin dose	Dispense Package
VANCOMYCIN 1 GRAM/200 ML IN 0.9 % SOD. CHLORIDE INTRAVENOUS PIGGYBACK	1,000 mg	1,000 mg	200 mL Flex Cont x1

**BestPractice Advisory - Enell-Beacon\_Poc,Adult**

**ⓘ Patient has a "Once" order for vancomycin and no "intermittent dosing" order. Please enter an "intermittent dosing" order if needed.**

OK

# “Intermittent Dosing” Order

## Other FAQs

- **What if I have a newly admitted or ED patient with missing information about renal function, weight, etc.?**
  - Enter (or verify and dispense) one-time dose for first dose (no chart note needed at this point)
  - Enter “intermittent dosing order,” and place an iVent stating one-time dose given, waiting for labs to determine ongoing dosing. If the expectation is that this follow-up and determination will be done by a different pharmacist than the one placing the iVent, also page that pharmacist to notify them of follow-up needed.
  - Once labs return:
    - If appropriate for scheduled dosing: pharmacist will schedule doses and d/c the intermittent order, write note and document in scoring tool. OR
    - If appropriate for dosing by levels: pharmacist will determine appropriate follow-up level timing and order level or handoff via iVent and/or scoring tool depending on timing of level needed
- **What if a prescriber needs to change a patient from scheduled dosing to dosing by levels due to acute change in renal function?**
  - They will need to contact a pharmacist to enter the “Intermittent Dosing” order
- **Separate order is needed for each drug: vancomycin, amikacin, tobramycin, gentamicin, streptomycin**

# Sticky Notes

- *Kinetics Indication and Goal*: ONLY include indication and goal here as this information will be pulled into medication management note.
  - Utilize dot phrases (.rxvanco and .rxamino)
- *Miscellaneous Kinetics Documentation*: pharmacist to pharmacist communication



**Pharmacist's Sticky Note** Comment

**Kinetic Indication and Goal:** Comment

**What is the indication and/or goal for Vancomycin/Aminoglycoside therapy?** Comment

This is the OLD (current) sticky note. This will stay until Friday afternoon, so we have a chance to convert information into the NEW sticky notes (above and below).  
Last edited by Um\_Rx, Pharmacist on 06/28/16 at 1503

**Miscellaneous Kinetic Documentation** Comment

New sticky note for internal communication - you can type whatever you want here just for pharmacist to pharmacists communication

Example: Course of therapy to end 7/1/16, should not need any more levels.  
Last edited by Um\_Rx, Pharmacist on 06/28/16 at 1503

Click comment next to the “Kinetics Indication and Goal” sticky note. Type “.rxvanco” (or “.rxamino” for aminoglycosides)

Comments

.rxvanco

Abbrev	Expansion
★ RXVANCO	Indication: {Kinetic Indication:24296} Vancomycin goal trough: {T...
☆ RXVANCOIND	{Vancomycin Indication:24296}

Refresh (Ctrl+F11) Close (Esc)

Accept Cancel

Comments

Indication: {Kinetic Indication:24296}  
Vancomycin goal trough: {Trough G

- Bacteremia
- Line Infection
- CNS Infection
- Pneumonia
- UTI
- Pyelonephritis
- Intra-abdominal Infection
- Endocarditis
- Hardware Infection
- Osteomyelitis
- Cellulitis
- Septic Joint

Accept Cancel

A drop down for vancomycin indication and goal (trough or AUC) are included:

Comments

Indication: {Kinetic Indication:24296}  
Vancomycin goal trough: {Trough Goal:304025073} mcg/ml

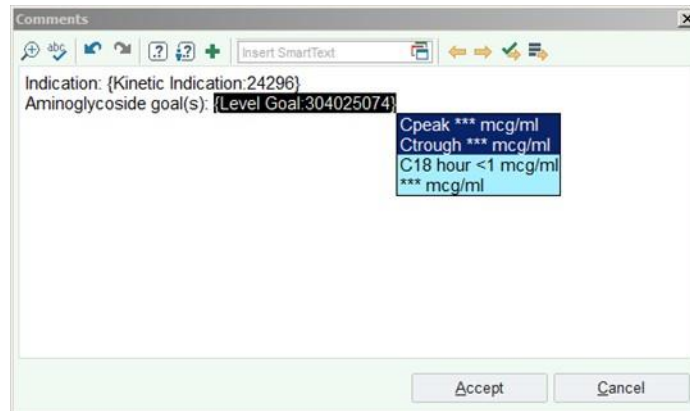
- 10-15
- 15-20
- 10-20
- \*\*\*

Accept Cancel

Once you have selected an appropriate indication and goal, the text will populate in the sticky note:

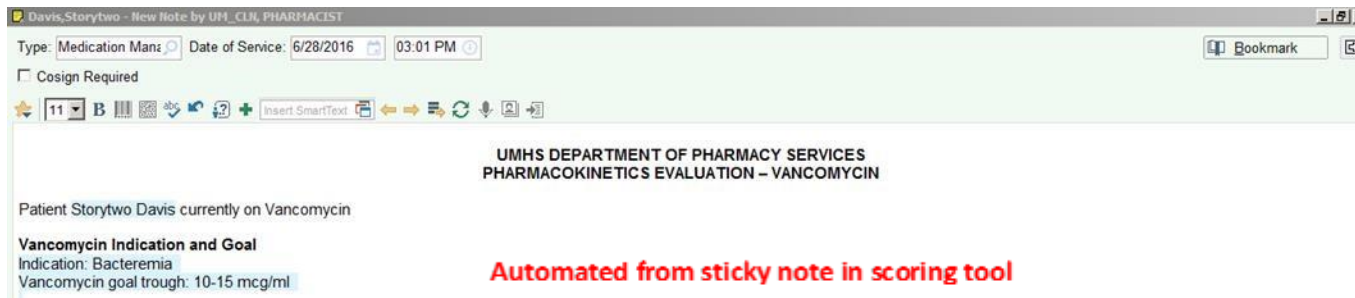
Kinetic Indication and Goal:	Comment
Indication: Bacteremia Vancomycin goal trough: 10-15 mcg/ml	Last edited by Um_Rx, Pharmacist on 06/28/16 at 1511

For aminoglycosides (using .rxamino), you can select multiple goal levels for peak/trough, etc.:



# PK Note Templates

- Once the sticky notes in the scoring tool have been completed, indication and goal will be automatically pulled into the medication management note as seen below.



The screenshot shows a web-based interface for a medication management note. At the top, the window title is "Davis, Storytwo - New Note by UMH\_CLJL, PHARMACIST". Below the title bar, there are fields for "Type: Medication Manag", "Date of Service: 6/28/2016", and "03:01 PM". A "Bookmark" button is visible on the right. A "Cosign Required" checkbox is present and unchecked. A rich text editor toolbar is shown with various icons for text formatting and editing. The main content area contains the following text:

UMHS DEPARTMENT OF PHARMACY SERVICES  
PHARMACOKINETICS EVALUATION – VANCOMYCIN

Patient Storytwo Davis currently on Vancomycin

**Vancomycin Indication and Goal**  
Indication: Bacteremia  
Vancomycin goal trough: 10-15 mcg/ml

Automated from sticky note in scoring tool

For administration, you can choose if you want to include doses given in the last 24 hours, 48 hours, or 72 hours.

UMHS DEPARTMENT OF PHARMACY SERVICES  
PHARMACOKINETICS EVALUATION – VANCOMYCIN

Patient Storytwo Davis currently on Vancomycin

**Vancomycin Indication and Goal**  
Indication: Bacteremia  
Vancomycin goal trough: 10-15 mcg/ml

Renal Replacement Therapy: (Renal Replacement Therapy:304025039)

Weight: (Weight Options:304025056)

Scr (mg/dL):

CREATININE	Date	Value	Ref Range	Status
	12/23/2015	1.6	0.5 - 1 mg/dL	Final
	12/23/2015	1	0.5 - 1 mg/dL	Final

Vancomycin administrations:  
(RX Vanco Administrations:304025060)

Serum concentrations:  
No results found for: VANCOTR, VANC

(LNK.MEDSVANCOADMIN24)  
(LNK.MEDSVANCOADMIN48)  
(LNK.MEDSVANCOADMIN72)

Select administration in last 24 hours, 48 hours, or 72 hours

**PEDIATRIC ONLY:** select the nephrotoxic medications the patient is currently receiving

Note: IV contrast and amphotericin count as 7 day exposures.

Type: Medication Manag Service: Pharmacy Servi Date of Service: 10/8/2018 01:02 PM

Cosign Required

Insert SmartText

**UMHS DEPARTMENT OF PHARMACY SERVICES  
PEDIATRIC PHARMACOKINETIC EVALUATION – VANCOMYCIN**

Patient Coraline Jones is currently receiving vancomycin therapy.

**Vancomycin Indication and Goal**  
 Indication: open chest prophylaxis  
 Vancomycin goal trough: 5-10 mcg/ml

Weight: {Weight Options:304025056}

**Renal Function Assessment:**  
 SCr (mg/dL):

Date	Value	Ref Range	Status
10/8/2018	<0.10	mg/dL	Final
10/8/2018	0.11	mg/dL	Final
10/7/2018	<0.10	mg/dL	Final

Patient is receiving: {Peds Renal Replacement Therapy:304025192}

Patient is currently receiving the following medications which may contribute to nephrotoxicity:

- {RXNEPHRO:304025189}

**Vancomycin Therapy:**  
 Vancomycin administrations:  
 {RX Vanco Administrations:304025189}

Serum concentrations:  
 Lab Results

Component	Value	Date/Time
VANCOTR	7.4	10/8/2018 1214
VANCOTR	10.5	10/7/2018 1800

**Assessment/Plan:**

- Vanco trough was drawn { :30\*\*\*
- {RX Peds Vanco Plan:304025189}

ACEi/ARB  
 Aminoglycosides  
 Amphotericin B  
 Antivirals  
 Carboplatin/cisplatin/ifosfamide  
 Diuretics  
 IV contrast  
 NSAIDs  
 Piperacillin-tazobactam  
 Tacrolimus/sirolimus/cyclosporine  
 Vancomycin  
 Vasopressors

046] represent a steady state level.

← Select all nephrotoxic medications the patient is currently receiving

# Example of the full “vancomycin medication management note” template.

Davis, Storytwo - New Note by UP1\_CLJ, PHARMACIST

Type: Medication Man Date of Service: 6/28/2016 03:01 PM

Cosign Required

11 B [Rich Text Editor Icons] Insert SmartText

**UMHS DEPARTMENT OF PHARMACY SERVICES  
PHARMACOKINETICS EVALUATION – VANCOMYCIN**

Patient Storytwo Davis currently on Vancomycin

**Vancomycin Indication and Goal**  
Indication: Bacteremia  
Vancomycin goal trough: 10-15 mcg/ml

Renal Replacement Therapy: {Renal Replacement Therapy:304025039}

Weight: {Weight Options:304025056}

Scr (mg/dL):

CREATININE	Date	Value	Ref Range	Status
	12/23/2015	1.6	0.5 - 1 mg/dL	Final
	12/23/2015	1	0.5 - 1 mg/dL	Final

Vancomycin administrations:  
{RX Vanco Administrations:304025060}

Serum concentrations:  
No results found for: VANCOTR, VANC

**Assessment/Plan:**

1. Assessment: Vancomycin level was drawn \*\*\* hours after the last dose was administered {RX Serum Level:304025032} a steady state level. Vancomycin level is {RX Level Goal:304025033}. Renal function is {RX Renal Function:304025034}.
2. Plan: {RX Vanco Plan:304025035} Next level will be ordered \*\*\*.
3. Pharmacy will continue to monitor vancomycin therapy. Please page with questions.

Pharmacist  
{RX Pager :304025036}  
6/28/2016  
3:02 PM

**Annotations:**

- Automated from sticky note in scoring tool (points to Vancomycin goal trough)
- Dosing weight OR Actual Body Weight (points to Weight)
- Select administration in last 24 hours, 48 hours, or 72 hours (points to Vancomycin administrations)
- Automated for last 72 hours (points to Assessment/Plan)
- Drop down options for assessment/plan (points to Assessment/Plan)

Example of the full “aminoglycoside medication management note” template. Similar to vancomycin template.

Davis, Storytwo - New Note by UH\_CJL, PHARMACIST

Type: Medication Manag Date of Service: 6/28/2016 03:15 PM

Cosign Required

11 B [Rich Text Editor Icons]

**UMHS DEPARTMENT OF PHARMACY SERVICES  
PHARMACOKINETICS EVALUATION – AMINOGLYCOSIDE**

Patient Storytwo Davis currently on {aminoglycoside:24265}

**Aminoglycoside Indication and Goal**  
 Indication: Bacteremia  
 Vancomycin goal trough: 10-15 mcg/ml

amikacin  
 gentamicin  
 tobramycin  
 streptomycin

← select specific agent

Renal Replacement Therapy: {Renal Replacement Therapy:304025039}

Weight: {Weight Options:304025056}

Scr (mg/dL):

CREATININE	Date	Value	Ref Range	Status
	12/23/2015	1.6	0.5 - 1 mg/dL	Final
	12/23/2015	1	0.5 - 1 mg/dL	Final

Aminoglycoside administrations:  
 {RX Aminoglycoside Administrations:304025075}

Serum concentrations:  
 No results found for: TOBR, TOBPK, TOBTR, AMIKR, AMIKPK, AMIKTR, STREPM, GENTR, GENTPK, GENTTR

Calculated kinetic parameters:  
 Ke = \*\*\*  
 T 1/2= \*\*\*  
 Cpeak = \*\*\*  
 Ctrough= \*\*\*  
 VD= \*\*\*

Assessment/Plan:  
 1. Assessment: {aminoglycoside:24265} peak is {RX Level Goal:304025033} and trough is {RX Level Goal:304025033}. Renal function is {RX Renal Function:304025034}  
 2. Plan: {RX Aminoglycoside Plan:304025072} Next level will be ordered \*\*\*.  
 3. Pharmacist will continue to monitor {aminoglycoside:24265} therapy. Please page with questions.

Pharmacist  
 {RX Pager :304025036}  
 6/28/2016  
 3:15 PM

Example of the full “vancomycin AND aminoglycoside medication management note” template. Similar to vancomycin template.

Davis, Storytwo - New Note by UH\_CLI, PHARMACIST

Type: Medication Management Date of Service: 6/28/2016 03:16 PM

Cosign Required

11 B abc ? + Insert SmartText

**UMHS DEPARTMENT OF PHARMACY SERVICES  
PHARMACOKINETICS EVALUATION – VANCOMYCIN AND AMINOGLYCOSIDE**

Patient Storytwo Davis currently on vancomycin and {aminoglycoside:24265}

**Vancomycin/Aminoglycoside Indication and Goal**  
 Indication: Bacteremia  
 Vancomycin goal trough: 10-15 mcg/ml  
 Renal Replacement Therapy: {Renal Replacement Therapy:304025039}

Weight: {Weight Options:304025056}

Scr (mg/dL):

CREATININE	Date	Value	Ref Range	Status
	12/23/2015	1.6	0.5 - 1 mg/dL	Final
	12/23/2015	1	0.5 - 1 mg/dL	Final

**Administered Vancomycin (last 24 hours)**

Date/Time	Action	Medication	Dose
06/28/16 1202	New Bag	vancomycin (VANCOCIN) 1,500 mg in sodium chloride 0.9 % 290 mL IVPB	1,500 mg
06/28/16 1154	New Bag	vancomycin (VANCOCIN) 1,500 mg in sodium chloride 0.9 % 290 mL IVPB	1,500 mg

Serum concentrations:  
No results found for: VANCOTR, VANCOR

{RX Aminoglycoside Administrations:304025075}

Serum concentrations:  
No results found for: TOBR, TOBPK, TOBTR, AMIKR, AMIKPK, AMIKTR, STREPM, GENTR, GENTPK, GENTTR

Calculated kinetic parameters:  
 Ke = \*\*\*  
 T 1/2= \*\*\*  
 Cpeak = \*\*\*  
 Ctrough= \*\*\*  
 VD= \*\*\*

**Assessment/Plan:**  
**Vancomycin**  
 1. Assessment: Vancomycin level was drawn \*\*\* hours after the last dose was administered {RX Serum Level:304025032} a steady state level. Vancomycin level is {RX Level Goal:304025033}. Renal function is {RX Renal Function:304025034}.  
 2. Plan: {RX Vanco Plan:304025035} Next level will be ordered \*\*\*.

**Aminoglycoside**  
 1. Assessment: {aminoglycoside:24265} peak is {RX Level Goal:304025033} and trough is {RX Level Goal:304025033}. Renal function is {RX Renal Function:304025034}.  
 2. Plan: {RX Aminoglycoside Plan:304025072} Next level will be ordered \*\*\*.

Pend Share Sign Cancel

← Example of administration history from last 24 hours



# Example of the full “pediatric vancomycin medication management note” template (similar to other pediatric PK templates)

Type: Medication Manag Service: Pharmacy Servi Date of Service: 10/8/2018 01:03 PM  
 Cosign Required

UMHS DEPARTMENT OF PHARMACY SERVICES  
 PEDIATRIC PHARMACOKINETICS EVALUATION – VANCOMYCIN

Patient Coraline Jones currently receiving vancomycin therapy.

**Vancomycin Indication and Goal**  
 Indication: open chest prophylaxis  
 Vancomycin goal trough: 5-10 mcg/ml

← Automated from sticky note in scoring tool

Weight: {Weight Options:304025056}

← Dosing weight OR Actual Body Weight

**Renal Function Assessment:**

SCr (mg/dL):

Date	Value	Ref Range	Status
10/8/2018	<0.10	mg/dL	Final
10/8/2018	0.11	mg/dL	Final
10/7/2018	<0.10	mg/dL	Final

Patient is receiving: {Peds Renal Replacement Therapy:304025192}

Patient is currently receiving the following medications which may contribute to nephrotoxicity:

- {RXNEPHRO:304025189}

← Select all nephrotoxic medications the patient is currently receiving

**Vancomycin Therapy:**

Vancomycin administrations:  
 {RX Vanco Administrations:304025060}

← Select administration in last 24 hours, 48 hours, or 72 hours

**Serum concentrations:**

Component	Value	Date/Time
VANCOTR	8.0	10/8/2018 1152
VANCOTR	7.4	10/7/2018 1214

← Automated for last 72 hours

**Assessment/Plan:**

1. Vanco trough was drawn { :304025203} \*\*\* hours after dose and { :39046} represent a steady state level.
2. {RX Peds Vanco Plan:304025196}
3. {RX Peds Kinetic Monitoring:304025201}
4. Pharmacist will continue to monitor vancomycin therapy and order vancomycin level appropriately.

← Drop down options for assessment/plan

Please page with questions.

Nicholas Dillman  
 Pager #\*\*\*  
 10/8/2018

# Vancomycin Workflow Updates

- As of 3/3/2012, vancomycin will be removed from tier II workflow
- Avoid obtaining levels in first 48-72 hours, unless significant changes to renal function, septic shock, morbid obesity
- For patients that need therapy beyond 48-72 hours, target AUC of 400-600. Order random level and trough, then use AUC calculator
- Document vancomycin-specific iVent following vancomycin monitoring
- Document goal AUC and personalized trough range in the notes. The trough range will be used when transitioning to home therapy

# EPIC Kinetics Dashboard Updates

The screenshot displays the EPIC Kinetics Dashboard with several key sections and updates highlighted in red boxes:

- Kinetic Indication and Goal:** A new banner for "Vancomycin duration > 72 hours" is highlighted.
- Appropriateness / Miscellaneous Kinetic Documentation:** A new section for documenting miscellaneous notes is highlighted.
- I-Vent Documentation:** A link to "I-Vent Documentation - Select 'Vancomycin Monitoring'" is highlighted.

The dashboard also includes a "Kinetics Monitoring" section with a score of 15 points, a table of Vancomycin orders, and an "Antibiotic Monitoring" section with a timeline view for 02/14/2021.

Start	Dose/Rate
02/15/21 1315	vancomycin (VANOCIN) 750 mg in sodium chloride 0.9 % 100 mL IVPB 750 mg

New banner that appears when vancomycin has been administered > 72 hours

Location for documenting miscellaneous notes including appropriateness of therapy. Pharmacists are expected to assess daily if vancomycin is indicated. If vancomycin is deemed inappropriate, pharmacists should communicate need for discontinuation with the primary team. Pharmacists may page the antimicrobial approval pager (30780) of stewardship pharmacists for assistance in discontinuing vancomycin, when needed

Link to I-Vent documentation (see page 33)

# Adult Vancomycin Monitoring Recommendations within 72 hours of Vancomycin Initiation

## Monitoring within 72 hours of Vancomycin Initiation

Vancomycin levels should be unnecessary if therapy not anticipated to exceed 72 hours. Recommend discontinuation of vancomycin 48-72 hours after initiation if there is no indication to continue therapy. Approximately 90% of patients will have vancomycin discontinued within 48-72 hours and do not require levels.

Do not check vancomycin concentrations within the first 72 hours except in the following situations:

Clinical Situation	Monitoring Recommendation
Documented gram positive infection requiring vancomycin	<ul style="list-style-type: none"> <li>Obtain 2 <b>vancomycin</b> levels at steady state and calculate AUC to achieve goal AUC of 400-600</li> <li>Obtain a random level ~4 hours post-infusion and a trough <b>prior</b> to the next dose for most patients</li> </ul>
Septic shock	
Weight > 150 kg	
Significant acute changes in renal function, AKI, or CrCl < 25 ml/min	<ul style="list-style-type: none"> <li>Obtain a <b>vancomycin</b> level and dose per level</li> <li>Monitor random levels in patients and re-dose when level &lt; 15 mcg/mL</li> </ul>

AUC is the preferred method of vancomycin monitoring, with daily goal AUC of 400-600 regardless of MIC. Trough-based monitoring should not be routinely used, unless dosing by levels within the first 72 hours.

# Adult Vancomycin Monitoring Recommendations after 72 hours of Vancomycin Initiation

## Monitoring after 72 hours of Vancomycin Initiation

Recommend discontinuation of vancomycin 48-72 hours after initiation if there is no indication to continue therapy. Consider ID consult in patients with confirmed MRSA infection who do not improve on vancomycin. ID consult should be ordered for all patients with MRSA bacteremia.

Use the following table to guide monitoring of vancomycin based on the patient's clinical status:

Clinical Situation	Monitoring Recommendation
Patients with stable renal function (including patients with CKD and receiving CRRT)	<ul style="list-style-type: none"> <li>Obtain 2 vancomycin levels after the first dose and calculate AUC to achieve goal AUC of 400-600</li> <li>Obtain a random level ~4 hours post-infusion and a trough prior to the next dose for most patients to calculate AUC</li> <li>Document individualized trough range that corresponds to AUC of 400-600 for that patient</li> </ul>
Patients on conventional dialysis	<ul style="list-style-type: none"> <li>Check pre-HD level (preferred for floor patients) or 3-hr post-HD level (preferred for ICU patients)</li> <li>Target pre-HD levels of 15-20 mcg/ml, or post-HD level of 10-15 mcg/mL</li> </ul>
Patients who have fluctuating fluid and/or renal status	<ul style="list-style-type: none"> <li>Use clinical judgement to determine monitoring strategy</li> <li>It is reasonable to perform AUC or trough based monitoring. The instability of renal clearance or volume of distribution should be taken into account when evaluating levels and subsequent dosing</li> </ul>

## Frequency of Vancomycin Levels and Monitoring

- Serum Creatinine should be monitored at least every 48 hours
- Subsequent levels should be obtained:
  - Every 1-3 days if significant changes to vancomycin dose, renal function or fluid status
  - Every 3-5 days if on a stable dose with multiple AUCs of 400-600 and stable fluid status and renal function
- Avoid evening and overnight levels if clinically stable

# Pediatric Vancomycin Monitoring Recommendations within 48 hours of Vancomycin Initiation

## Monitoring within 48 hours of starting vancomycin:

1. Vancomycin levels should be unnecessary if therapy not anticipated to exceed 48 hours.
2. Do not check vancomycin concentrations within the first 48 hours except in the following situations:

Clinical Situation	Monitoring Recommendation
<b>Approximately 90% of patients will have vancomycin discontinued within 48-72 hours and most patients do not require levels</b>	
Documented gram positive infection	<ul style="list-style-type: none"> <li>• Obtain 2 vancomycin levels at steady state and calculate AUC to achieve goal AUC of 400-600</li> <li>• Obtain a random level ~2 hours post-infusion and a trough prior to the next dose for most patients</li> </ul>
Septic shock	
Weight >100 kg	
Children with low muscle mass (e.g. muscular dystrophy, cerebral palsy, spinal muscular atrophy)	
Significant acute changes in renal function, CrCl <30 mL/min, therapeutic hypothermia, ECMO, AKI, or neonates <72 hours old whose mothers received peri-partum vancomycin	<ul style="list-style-type: none"> <li>• Obtain a vancomycin level and dose per level</li> <li>• Monitor random levels in patients and re-dose when level &lt;15 mcg/mL</li> </ul>

# Pediatric Vancomycin Monitoring Recommendations after 48 hours of Vancomycin Initiation

## Monitoring after 48 hours of starting vancomycin:

1. Use the following table to guide monitoring of vancomycin based on the patient's clinical status:

Clinical Situation	Monitoring Recommendation
Patients with stable renal function (including patients with CKD and receiving CRRT)	<ul style="list-style-type: none"> <li>Obtain 2 vancomycin levels at steady state and calculate AUC to achieve goal AUC of 400-600</li> <li>Obtain a random level ~2 hours post-infusion and a trough prior to the next dose for most patients to calculate AUC</li> <li>Document individualized trough range that corresponds to AUC of 400-600 for that patient</li> </ul>
Patients on conventional dialysis	<ul style="list-style-type: none"> <li>Check pre-HD level</li> <li>Target pre-HD levels of &lt;15</li> </ul>
CHC patients within 72 hours of surgery	<ul style="list-style-type: none"> <li>Check trough concentration</li> <li>Redose for trough &lt;10</li> </ul>
Patients who have fluctuating fluid and/or renal status	<ul style="list-style-type: none"> <li>Use clinical judgement to determine monitoring strategy</li> <li>It is reasonable to perform AUC or trough-based monitoring. The instability of renal clearance or volume of distribution should be taken into account when evaluating levels and subsequent dosing</li> </ul>

2. Dose should not exceed 100 mg/kg/day at any point in therapy.

3. Consider ID consult in patients with confirmed MRSA infection who do not improve on vancomycin. ID consult should be ordered for all patients with MRSA bacteremia.

4. Refer to the following table for recommendations on frequency of ordering vancomycin levels and serum creatinine:

Clinical Situation	Monitoring Recommendation
<b>Subsequent levels should be drawn every 1-7 days, and serum creatinine should be monitored at least every 48 hours during entire course of vancomycin therapy. Avoid evening and overnight levels if clinically stable.</b>	
Patients with changing fluid status or renal function	<ul style="list-style-type: none"> <li>Obtain levels every 1-3 days</li> <li>Monitor 2 vancomycin levels to facilitate AUC calculation, when possible</li> <li>In patients receiving one-time doses (i.e., dosing by level), monitor random levels and re-dose when level &lt;15 mcg/mL</li> </ul>
Patients with stable fluid status and renal function requiring long-term therapy	<ul style="list-style-type: none"> <li>Obtain levels every 5-7 days, after initial level(s) are therapeutic</li> <li>Once a patient is on a stable dose with an AUC between 400 and 600, monitoring of vancomycin troughs may be acceptable in patients with stable fluid status and renal function</li> </ul>

# Vancomycin AUC Calculator

- Posted on stewardship website, pharmacy website, and linked from pharmacy EPIC PK tab
- [https://www.med.umich.edu/asp/misc/UMich\\_PK\\_Calculator.xlsx](https://www.med.umich.edu/asp/misc/UMich_PK_Calculator.xlsx)



# Vancomycin I-Vents

- To be completed upon evaluation of level(s) (i.e., after trough and two levels for AUC calculations)
- Select “Vancomycin Monitoring” as Type and the correct response (as seen on image) as subtype

The screenshot displays the EpicCare EMR interface for a patient named Adt-Vasher, Rn Rtm. The 'Kinetics' tab is selected, and the 'I-Vent Documentation' section is highlighted. A red box highlights the 'Subtype' dropdown menu, which lists various monitoring options with their corresponding numbers.

Title	Number
AUC, sub-therapeutic	1109
AUC, supra-therapeutic	1111
AUC, therapeutic	1110
Not applicable (i.e., dosing by levels)	1115
Trough, sub-therapeutic	1112
Trough, supra-therapeutic	1114
Trough, therapeutic	1113

# Personalized Trough Range

- Use AUC calculator to determine personalized trough range
- Personalized trough range should be documented in PK notes
- Trough range will be used when transitioning to trough-based monitoring for home therapy