

## AUC calculations and procedure Job-aide

1. Does the patient have changing renal function? If yes, **do not calculate the AUC** and continue to use trough goal of 10-20 mcg/ml.
2. Does the patient meet the criteria for AUC measurement? **If yes to any of the following questions, proceed to Step 3.**
  - i. Severe documented MRSA infection (including bacteremia, endocarditis, prosthetic joint infection, pneumonia, osteomyelitis, or meningitis).
  - ii. Vancomycin dose greater than > 4g/day without achieving a minimum trough of 10 mcg/ml.
  - iii. Long term vancomycin (i.e > 2 weeks) for any indication.
3. Schedule **two post-distribution levels** (i.e peak and trough) after the patient reaches a steady state. Levels do not need to be drawn around the same dose.
  - i. Optimal timing is peak and trough but defer to clinical judgement for utilizing any two detectable levels, drawn at least 2 hours apart.
    - a. Peak: 1-4 hours after the end of the infusion.
      1. There is not a preference but choosing the method that is least disruptive to the patient (i.e. adding on a vancomycin level with AM labs is ok).
      2. There must be at least 30 minutes between the end of the infusion and the measurement of the peak concentration to allow for adequate drug distribution.
    - b. Trough: 30 minutes prior to dose.
    - c. Attempt to time levels and perform calculations during clinical day shift.
    - d. To ensure proper handoff, please denote in "Documentation" in Vancomycin IVENT that patient is transitioning to "AUC-based dosing" and make sure denote the new trough goals.
4. Once the levels return, **write down all the levels and corresponding doses and times.**
  - i. Use an AUC calculator to determine the vancomycin AUC. We prefer Sanford calculator due to ease of use and the ability to use levels from intervals. This can be accessed thru the health sciences library at hsl.uw.edu or pharmacy staff website. You may need your uwnetid to login.
    - a. <https://webedition.sanfordguide.com/en/comparisons-1/calculators/sg-one-calculators-vancomycin>
    - b. Sanford calculator is preferred since it allows for input of peak and trough levels and easier modifications to assess AUC and predicted peak and trough levels
      1. Search for "Vancomycin AUC calculator" into Sanford

The screenshot shows the top portion of a web application. At the top, it says "SANFORD GUIDE" and "WEB EDITION" with a red logo containing the Chinese characters "熱病" (Hot Disease). Below this is a search bar with the text "Search: Search Site". A navigation menu contains the following items: Syndromes, Pathogens, Anti-infectives, HIV/AIDS, Hepatitis, Prevention, Activity Spectra, and Tables & Tools. The main heading is "Vancomycin AUC Calculator". At the bottom, a small copyright notice reads: "by Douglas Black, Pharm.D. last updated Jul 30, 2020 9:24 AM © Antimicrobial Therapy, Inc."

- ii. Enter patient specific information; goal AUC is 400-600 µg/mL x hr.

### Vancomycin AUC<sub>24</sub> Calculator

The critical assumption of these calculations is that the patient has achieved Vancomycin steady-state  
Target AUC<sub>24</sub> is 400-600 µg/mL x hr

Each Dose:	<input type="text" value="1500"/>	mg
Dosing Interval:	<input type="text" value="8 hours"/>	▼
Duration of infusion:	<input type="text" value="30 min"/>	▼
Measured Vancomycin Peak Concentration:	<input type="text" value="36"/>	µg/mL
Time from start of infusion to measurement of peak concentration:	<input type="text" value="2"/>	hours
Measured Vancomycin Trough Concentration:	<input type="text" value="18"/>	µg/mL
Time from start of infusion to measurement of trough concentration:	<input type="text" value="11.5"/>	hours
<input type="button" value="Calculate"/>		<input type="button" value="Clear"/>

**Results: AUC<sub>24</sub> = 744 µg/mL x hr**

If the peak level is drawn too soon after the end of the infusion (< 30 mins), it will not calculate the AUC and show the notification below:

**There must be at least 30 minutes between the end of the infusion and the measurement of the peak concentration to allow for adequate drug distribution.**

- a. To note the Sanford AUC calculator can calculate true peak and trough, go to Show Calculations. You can also save

Adjust Dose
Show Calculations
Print / Save as PDF
Copy Results as Plain Text

<p style="text-align: center;"><b>Step 1: Calculate k<sub>e</sub></b></p> $k_e = \frac{\ln\left(\frac{\text{Measured Peak}}{\text{Measured Trough}}\right)}{T_2 - T_1}$ <p style="text-align: center;">k<sub>e</sub> = 0.073 hr<sup>-1</sup></p>	<p style="text-align: center;"><b>Step 2: Calculate True Peak</b></p> $\text{True Peak} = \frac{\text{Measured Peak}}{e^{-(k_e)(T_1 - T_{inf})}}$ <p style="text-align: center;">True Peak = 40.2 µg/mL</p>	<p style="text-align: center;"><b>Step 3: Calculate True Trough</b></p> $\text{True Trough} = (\text{Measured Trough})(e^{-(k_e)(T_2 - T_1)})$ <p style="text-align: center;">True Trough = 23.2 µg/mL</p>
<p style="text-align: center;"><b>Step 4: Calculate AUC<sub>inf</sub></b></p> $AUC_{inf} = \frac{(\text{True Trough} + \text{True Peak})}{2} (T_{inf})$ <p style="text-align: center;">AUC<sub>inf</sub> = 15.9 µg/mL x hr</p>	<p style="text-align: center;"><b>Step 5: Calculate AUC<sub>elim</sub></b></p> $AUC_{elim} = \frac{\text{True Peak} - \text{True Trough}}{k_e}$ <p style="text-align: center;">AUC<sub>elim</sub> = 232.0 µg/mL x hr</p>	<p style="text-align: center;"><b>Step 6: Calculate AUC<sub>24</sub></b></p> $AUC_{24} = [(AUC_{inf}) + (AUC_{elim})] \times \left(\frac{24}{T_{au}}\right)$ <p style="text-align: center;">AUC<sub>24</sub> = 744 µg/mL x hr</p>

- iii. Adjust dose in order to remain within goal range of 400-600  $\mu\text{g}/\text{mL} \times \text{hr}$ .

You are currently administering 4500 mg per day. Consider adjusting the daily dose to 2419 to 3629 mg per day.

New Dose:	<input type="text" value="1500"/>	mg
New Dosing Interval:	<input type="text" value="12 hours"/>	
New Duration of infusion:	<input type="text" value="30 min"/>	
<input type="button" value="Calculate"/>		<input type="button" value="Clear"/>

**Predicted AUC<sub>24</sub> = 496  $\mu\text{g}/\text{mL} \times \text{hr}$**

Predicted Peak = 30.4  $\mu\text{g}/\text{mL}$   
Predicted Trough = 13.2  $\mu\text{g}/\text{mL}$

- iv. From the calculator, determine the corresponding trough from the calculated AUC. If changing the dose or interval, **make sure to use the trough associated with the dose adjustment.** (ie 13.2 mcg/ml not 23.2 mcg/ml)

**Predicted AUC<sub>24</sub> = 496  $\mu\text{g}/\text{mL} \times \text{hr}$**

Predicted Peak = 30.4  $\mu\text{g}/\text{mL}$   
Predicted Trough = 13.2  $\mu\text{g}/\text{mL}$

- v. From the calculated AUC, create a direct proportion to determine the predicted trough goals that would correlate with AUC of 400 and 600  $\mu\text{g}/\text{mL} \times \text{hr}$ .
- $400/x = \text{calculated AUC}/\text{predicted trough}$ 
    - $x = \text{trough correlated with AUC of } 400 \mu\text{g}/\text{mL} \times \text{hr}$
  - $600/x = \text{calculated AUC}/\text{predicted trough}$ 
    - $y = \text{trough correlated with AUC of } 600 \mu\text{g}/\text{mL} \times \text{hr}$
  - The **new personalized trough goals (based on the daily dose)** for this patient to obtain an AUC of 400-600  $\mu\text{g}/\text{mL} \times \text{hr}$  are x to y
5. Recheck a trough level within 7 days if renal function is stable; check level sooner if renal functions worsen.
- Consider reassessment of AUC if volume status changes significantly or the vancomycin frequency is changed.
  - Upon rechecking trough, if the serum trough is higher than expected make a dose adjustment as you normally would using the previous trough goal values.
    - If there is significant clinical change (ie increase in SCr) requiring a change in the frequency, then recheck an AUC (i.e. after once SCr stabilizes) and calculate a new trough goal. You will need to use the previous trough goal of 10-20 mcg/ml until the SCr normalizes.**
  - Upon rechecking a trough, if serum trough is lower than expected and no clinical parameters have changed, increase the dose accordingly. If the dose adjustment requires a change in the frequency, then you will need to recalculate an AUC corresponding trough goal.
6. Please use available dotphrase **.AUCVANCO** in assessment and plan when writing a pharmacy Vancomycin Progress Note.
- ASK antimicrobial stewardship pharmacist to share this with you.

**AUC Verbiage (.dotphrase):**

Vancomycin dosing may be optimized by AUC monitoring due to \*\*\*\*

**Assessment:**

1. We used two post-distribution levels of \*\*\* µg/mL (**date and time**) and \*\*\* µg/mL (**date at time**) to calculate a vancomycin AUC.
2. Based on the current dosing regimen, we calculated an AUC of \*\*\* µg/mL x hr (target AUC is 400-600 µg/mL x hr) utilizing the Sanford vancomycin AUC calculator.

**Plan:**

1. From this calculation, we can give \*\*\* g IVPB every \*\*\* hours, which will correlate with an AUC of \*\*\* µg/mL x hr and corresponding trough in the goal range of \*\*\*-\*\*\*.
2. Plan to repeat level in \*\*\* days.