Clinical Monitoring of Outpatient Parenteral Antimicrobial Therapy (OPAT) and Selected Oral Antimicrobial Agents – Adult – Inpatient/Ambulatory – Clinical Practice Guideline

Table of Contents

Note: Active Table of Contents
Click to follow link

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Executive Summary

Guideline Overview
This document is intended to guide the laboratory monitoring of patients discharging on intravenous antimicrobials. Principles from the IDSA guidelines along with more recent evidence are incorporated in provided recommendations.

Target Population
Adults requiring antimicrobials in an outpatient setting

Key Revisions (Interim Update December 2016)
1. Addition of Appendix A to include guidance for coordination of discharge prescriptions and workflow for patients discharging with OPAT.

Key Practice Recommendations
Antimicrobials addressed in this guideline include:
- Aminoglycosides
- Beta-lactams
- Fluoroquinolones
- Daptomycin
- Linezolid
- Trimethoprim-sulfamethoxazole
- Glycopeptides
- Amphotericin B
- Echinocandins
- Azole antifungals
- Ganciclovir
- Acyclovir
- Foscarnet
- Cidofovir

Companion Documents
- UWHC Guidelines for the Pharmacokinetic/Pharmacodynamic Dose Optimization of Antibiotics (β-lactams, aminoglycosides, and ciprofloxacin) for the Treatment of Gram-Negative Infections in Adults
- UWHC Guidelines for the Intravenous Administration of Formulary Medications in Adults

Scope:
This document is intended to guide laboratory monitoring of adults prescribed OPAT and selected oral antimicrobial agents.

Disease/Condition(s):
Bacterial, fungal, or viral infections requiring intravenous antimicrobial in an outpatient setting

Clinical Specialty:
Infectious Disease

Intended Users:
Inpatient and outpatient physicians, pharmacists, nurses, primary care providers, and any other members of the healthcare team who may participate in management of patients receiving outpatient antimicrobial therapy

CPG objective:
To communicate evidence-based recommendations for OPAT laboratory monitoring

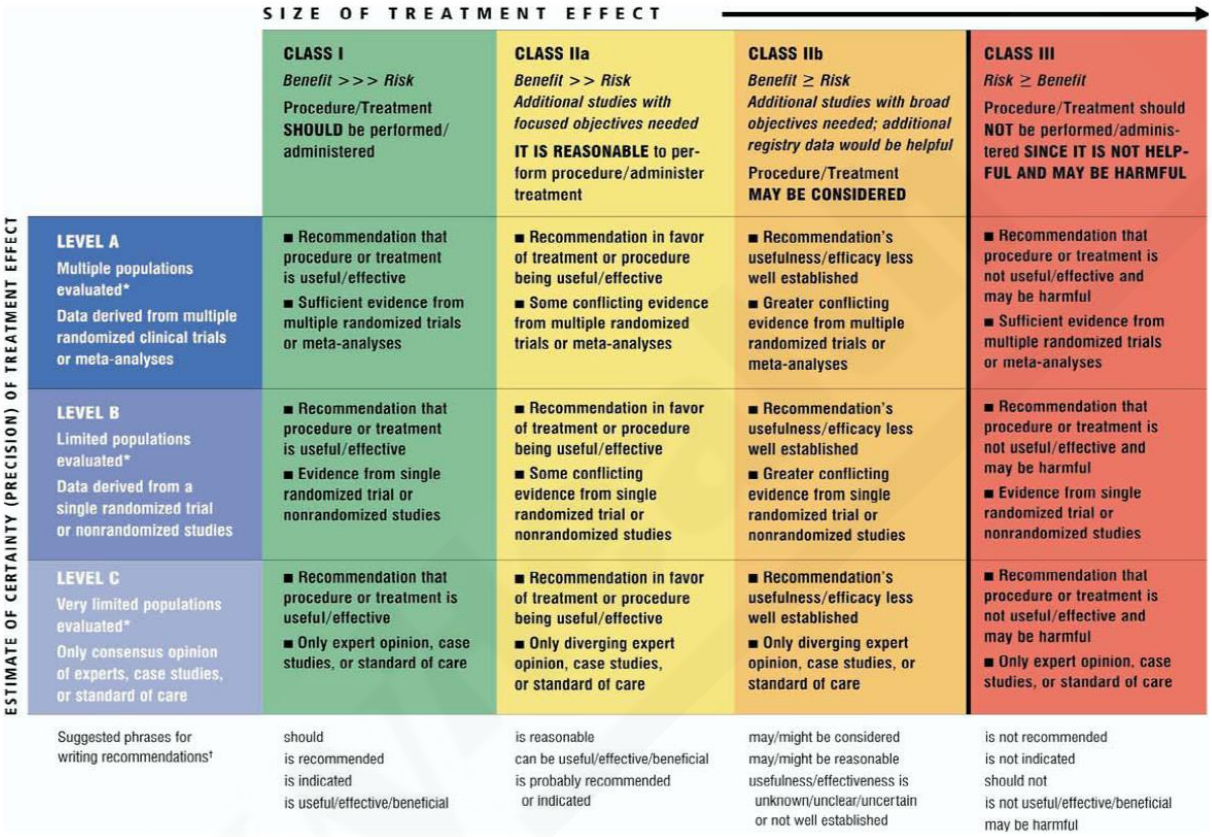
Target Population:
Adults requiring antimicrobials in an outpatient setting

Interventions and Practices Considered:
Ordering of laboratory tests

Methodology

Methods Used to Assess the Quality and Strength of the Evidence:

A modified Grading of Recommendations Assessment, Development, and Evaluation (GRADE) developed by the American Heart Association and American College of Cardiology Foundation has been used to assess the Quality and Strength of the Evidence in this Clinical Practice Guideline (Figure 1).[1]



ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT ↓ / SIZE OF TREATMENT EFFECT →	CLASS I *Benefit >>> Risk* Procedure/Treatment **SHOULD** be performed/ administered	CLASS IIa *Benefit >> Risk* *Additional studies with focused objectives needed* **IT IS REASONABLE** to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment **MAY BE CONSIDERED**	CLASS III *Risk ≥ Benefit* Procedure/Treatment should **NOT** be performed/administered **SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL**
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
Suggested phrases for writing recommendations†	should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	is not recommended is not indicated should not is not useful/effective/beneficial may be harmful

Methods Used to Collect/Select the Evidence:

Reviewed the Infectious Diseases Society of America (IDSA) OPAT practice guideline and cited sources, reviewed manufacturer product labeling, reviewed tertiary references and consulted with internal infectious disease physicians and pharmacists

Methods Used to Formulate the Recommendations:

Available evidence collected was compiled into a draft document for review by content experts on various committees (Antimicrobial Use Subcommittee, Pharmacy and Therapeutics Committee, Laboratory Committee)

Definitions[2]

1. **OPAT**: the provision of parenteral antimicrobial therapy in at least 2 doses on different days without intervening hospitalization
2. **Outpatient**: varied settings in which intravenous antimicrobial therapy can be provided without an overnight stay in a hospital. These include: home, physician's offices, hospital-based ambulatory-care clinics, emergency departments, hemodialysis units, freestanding infusion centers, skilled nursing or long-term care facilities, and rehabilitation centers.
3. **Parenteral**: intravenous, subcutaneous, and intramuscular routes of administrations
4. **Antimicrobial**: antiviral, antifungal, and antibacterial medications
5. **Caregiver**: any family member, friend, or paid nonprofessional individual with the ability and willingness to administer treatment and to observe and report significant side effects

A. Introduction

The growth of outpatient parenteral antimicrobial therapy (OPAT) has been fueled by a variety of factors including the development of antimicrobial agents that can be administered once daily, technological advances in vascular access and infusion devices, and availability of reliable and skilled services for OPAT in the community.[2] Initiation of OPAT requires that a physician determine that such therapy is needed to treat an infection for which hospitalization is not needed, and alternate routes of drug delivery are not feasible or appropriate. The healthcare team responsible for administration and monitoring of OPAT should appropriately monitor patients to avoid and address poor clinical responses, therapeutic failure, adverse effects, drug toxicity, or infusion device and vascular access issues. The Infectious Disease Society of America Practice Guidelines (IDSA) for OPAT describes the key elements in the appropriate and safe administration of parenteral antimicrobial therapy in the outpatient setting.[2] The guideline's recommendations are often based on expert opinion and further studies may be needed for determination of the response to therapy. Additional laboratory testing to monitor for efficacy of OPAT may be warranted based on individual patient characteristics. More frequent monitoring of laboratory parameters may be indicated if the healthcare team detects a trend toward toxicity or if an antimicrobial is given over an extended period of time.[3]

B. Recommendations

Table 1[a,b]: Recommendations for OPAT and selected oral antimicrobial agents monitoring[2,3]

	CBC with differential	Creatinine and BUN	Electrolytes[c]	Liver Enzymes[d]	Drug Concentration	Other
	Frequency of Testing per Week					
Aminoglycosides • gentamicin • tobramycin • amikacin	Once	Twice			Drug concentration(s) initially, weekly (for traditional and synergy dosing), and as indicated by increasing creatinine[5]	Clinical monitoring for vestibular and hearing dysfunction at each visit;
Beta-lactams • penicillins • cephalosporins • aztreonam • carbapenems • piperacillin-tazobactam	Once	Once		Once weekly with oxacillin, nafcillin and carbapenems		Monitor for delayed hemolytic anemia by CBC with ceftaroline[12]
Fluoroquinolones • ciprofloxacin • levofloxacin • moxifloxacin	Once[13]	Once[13]		Once		
Daptomycin	Once	Once		Once		CPK approximately weekly
Linezolid	Once					
Trimethoprim-sulfamethoxazole (high dose, >10 mg/kg TMP component)	Once	Once	Once: Potassium			
Glycopeptides • vancomycin • dalbavancin • oritavancin	Once	Once			Vancomycin drug concentration(s) should ideally be monitored weekly or more frequently as indicated by rising creatinine	
Antifungals						
Amphotericin B, including lipid formulations	Once	Twice	Twice: electrolytes Once: Magnesium	Once		

	CBC with differential	Creatinine and BUN	Electrolytes[c]	Liver Enzymes[d]	Drug Concentration	Other
	Frequency of Testing per Week					
Azole antifungals • fluconazole • voriconazole • posaconazole (oral) • itraconazole (oral) • isavuconazole (oral)	Once	Once		Once; fluconazole and itraconazole LFT may be monitored monthly if normal at baseline, and voriconazole biweekly or monthly once a stable pattern identified[3]	Steady state drug concentration levels should be considered after prophylaxis or therapy initiation, dose changes, or patient condition changes for voriconazole, itraconazole, and posaconazole.[26]	
Echinocandins • caspofungin • micafungin • anidulafungin	Once[29,30]			Once; when steady state established, can be monitored biweekly or monthly		
Antivirals						
Ganciclovir	Twice	Twice[32]	Twice: electrolytes[32]			Monitor labs twice a week at induction of therapy then once weekly thereafter[32]
Acyclovir	Once	Once				
Foscarnet	Once	Two to three times	Electrolytes + calcium and magnesium	Once		
Cidofovir	Once + prior to each dose	Once + within 48 hours of each dose	Once: electrolytes + prior to each dose	Once		

[a] Frequencies are minimal criteria for patients with normal or stable renal function. Different criteria may apply for children.
[b] Clindamycin, pentamidine, and quinupristin/dalfopristin are not included due to low use in outpatient parenteral therapy. If necessary, refer to IDSA OPAT Guideline.
[c] The electrolytes laboratory panel contains sodium, potassium, chloride, total carbon dioxide and anion gap. Calcium is included in the CMP; magnesium and phosphate are ordered separately.
[d] Liver enzyme function tests (include ALT, AST, alkaline phosphatase, and total bilirubin) are included in the CMP.

Antibiotic Agents

1.1. Aminoglycosides (gentamicin, tobramycin, amikacin)

1.1.1. Monitoring of once weekly CBC and twice weekly creatinine/BUN is recommended for aminoglycosides *(Class I, Level B)*[4]

1.1.2. Drug concentration monitoring

1.1.2.1. Traditional and synergy dosing

1.1.2.1.1. Aminoglycoside concentration monitoring should occur after five half-lives for synergy and traditional dosing *(Class IIa, Level B)*[5]

1.1.2.1.2. Trough drug concentrations should be monitored at least once weekly during prolonged therapy using traditional or synergy dosing (*Class I, Level A*)[5]

1.1.2.2. Extended interval dosing

1.1.2.2.1. A single drug concentration should be obtained between 6 and 14 hours after the start of the 60 minute aminoglycoside infusion. This drug concentration should be used with the appropriate nomogram to determine the interval for subsequent doses (*Class I, Level A*)[6]

1.1.2.2.2. After the dosing frequency is determined, trough concentrations should be drawn 30-60 minutes before the dose and can be used to monitor for nephrotoxicity and drug accumulation (*Class I, Level A*)[6]

1.1.2.3. Drug concentration monitoring varies depending on therapy (traditional, extended-interval dosing, or synergy). Refer to the "UWHC Guidelines for the Pharmacokinetic/Pharmacodynamic Dose Optimization of Antibiotics (β-lactams, aminoglycosides, and ciprofloxacin) for the Treatment of Gram-Negative Infections in Adults" for more information regarding aminoglycoside concentration monitoring.

1.2. Beta lactams (penicillins, cephalosporins, aztreonam, carbapenems, piperacillin-tazobactam)

1.2.1. Monitoring of once weekly CBC with differential and once weekly creatinine/BUN is reasonable for beta-lactams *(Class IIa, Level B)*[7-11]

1.2.2. When administering nafcillin, oxacillin, and carbapenems, it is reasonable to monitor liver enzymes once weekly *(Class IIa, Level B)*[7-10]

1.2.3. When administering ceftaroline, monitor for signs and symptoms of hemolytic anemia during and after treatment. If anemia develops, perform diagnostic studies including a direct Coomb's test *(Class I, Level B)*[12]

1.3. Fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin)

1.3.1. Monitoring of once weekly CBC with differential, creatinine/BUN, and liver enzymes is reasonable for fluoroquinolones *(Class IIa, Level B)*[13]

1.4. Daptomycin

1.4.1. Monitoring of once weekly CBC with differential, creatinine/BUN, and liver enzymes is reasonable for daptomycin *(Class IIa, Level B)*[14]

1.4.2. Monitoring of creatine phosphokinase (CPK) levels is indicated weekly, and more frequently in patients who received recent prior or concomitant therapy with a statin or in whom elevations in CPK occur during treatment with daptomycin *(Class I, Level A)*[14]

1.4.2.1. If elevated CPK or myopathy occurs, consider discontinuation of daptomycin

1.4.3. In patients with renal impairment, both creatinine/BUN and CPK should be monitored more frequently than once weekly *(Class I, Level A)*[14]

1.5. Linezolid

1.5.1. Monitoring of once weekly CBC with differential is recommended for linezolid *(Class I, Level A)*[15]

1.6. Trimethoprim-sulfamethoxazole *(high dose, >10 mg/kg based on TMP component)*

1.6.1. Monitoring of weekly CBC with differential, creatinine/BUN, and electrolytes (particularly potassium) is reasonable for trimethoprim-sulfamethoxazole *(Class IIa, Level B)*[16]

1.7. Glycopeptides (vancomycin, dalbavancin, oritavancin)

1.7.1. Once weekly CBC with differential and creatinine/BUN is reasonable for vancomycin, dalbavancin, and oritavancin *(Class IIa, Level B)*[17-19]

1.7.2. Trough vancomycin concentrations are the most accurate and practical method for monitoring vancomycin effectiveness *(Class IIa, Level B)*[20]

1.7.2.1. Recommend monitoring weekly trough concentrations for all patients receiving prolonged courses of vancomycin

1.7.2.2. More than weekly monitoring of trough vancomycin concentrations to reduce nephrotoxicity is recommended for patients with unstable renal function, for elderly patients, for those receiving aggressive dosing targeted to produce sustained trough drug concentrations of 15–20 mg/L, and for those who are at high risk of toxicity, such as patients receiving concurrent nephrotoxins

1.7.2.3. Frequent monitoring (more than a single trough concentration before the fourth dose) for short-course therapy (less than five days) or for lower-intensity dosing (targeted to attain trough vancomycin concentrations below 15 mg/L) is not recommended

Antifungals

1.0. Amphotericin B (including lipid formulations)

1.0.1. Monitoring of weekly CBC with differential, twice weekly creatinine/BUN, twice weekly electrolytes and magnesium, once weekly liver enzymes is reasonable for amphotericin B *(Class IIa, Level B)*[21]

1.1. Azole antifungal agents (fluconazole, voriconazole, itraconazole, posaconazole, isavuconazole)

1.1.1. Monitoring of weekly CBC with differential, weekly creatinine/BUN, and weekly liver enzymes is reasonable for azole antifungals *(Class IIa, Level B)*[22-25]

1.1.1.1. Fluconazole and itraconazole liver enzymes tests may be monitored monthly if normal at baseline, and voriconazole and posaconazole biweekly or monthly once a stable pattern is identified[3]

1.1.1.2. Monitoring parameters and frequency have not been established for isavuconazole[26]

1.1.2. Steady state drug concentration levels should be considered after prophylaxis or therapy initiation, dose changes, or patient condition changes for voriconazole, itraconazole, and posaconazole.[27,28] Refer to the "UWHC Guidelines for Antifungal Agents in Adults" for more information.

1.2. **Echinocandins** (caspofungin, micafungin, anidulafungin)

1.2.1. Monitoring of once weekly CBC with differential, electrolytes (particularly potassium) and liver enzymes is reasonable for echinocandins *(Class IIa, Level B)*[29,30]

1.2.1.1. Once steady state has been established, liver enzymes can be monitored biweekly or monthly

Antivirals

1.0. Ganciclovir

1.0.1. Monitoring of twice weekly CBC with differential, creatinine/BUN, and electrolytes is recommended during induction of ganciclovir therapy and once a week thereafter *(Class I, Level A)*[31,32]

1.1. Acyclovir

1.1.1. Monitoring of once weekly CBC with differential and creatinine/BUN is reasonable for acyclovir *(Class IIa, Level B)*[33]

1.2. Foscarnet

1.2.1. Monitoring of once weekly CBC with differential and liver enzyme tests is recommended for foscarnet *(Class I, Level A)*[34]

1.2.2. It is recommended to monitor renal function tests two to three times weekly during induction of therapy and at least every one to two weeks during maintenance. More frequent monitoring may be required for patients with renal impairment. It is also recommended that a 24-hour creatinine clearance be determined at baseline and periodically thereafter to ensure correct dosing *(Class I, Level A)*[31]

1.2.3. It is recommended to monitor electrolytes, calcium, and magnesium two to three times weekly during induction of therapy and at least every one to two weeks during maintenance *(Class I, Level A)*[31,34]

1.3. Cidofovir

1.3.1. Monitoring of once weekly CBC with differential, creatinine/BUN, and electrolytes, calcium, and magnesium is recommended for cidofovir *(Class IIa, Level B)*[35]

1.3.1.1. Monitoring of these parameters is recommended within 48 hours prior of each dose

1.3.2. Cidofovir should be used with caution in patients with renal dysfunction or significant proteinuria is detected and if patient is receiving concomitant nephrotoxic agents *(Class I, Level A)*[31,35]

C. Companion/Collateral documents

IDSA Outpatient Parenteral Antimicrobial Therapy (OPAT) Guideline

D. Potential Benefits

Standardization of OPAT laboratory ordering

E. Potential Harms

OPAT adverse drug events due to lack of individualization for patients that may require more frequent laboratory monitoring or additional tests.

F. Qualifying Statements

Recommendations presented are mostly based on expert opinion given that frequency of laboratory monitoring is not well established through evidence-based literature.

G. Implementation Plan and Tools

This guideline will be available as a reference link in the OPAT section of the Discharge Navigator in Healthlink available to inpatient clinical pharmacists responsible for medication discharge instructions. Education on this guideline will be distributed to pharmacists through a computer-based training on modifications of OPAT inpatient management. This guideline will also be available electronically through UConnect.

Disclaimer

CPGs are described to assist clinicians by providing a framework for the evaluation and treatment of patients. This Clinical Practice Guideline outlines the preferred approach for most patients. It is not intended to replace a clinician's judgment or to establish a protocol for all patients. It is understood that some patients will not fit the clinical condition contemplated by a guideline and that a guideline will rarely establish the only appropriate approach to a problem.

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Clinical Monitoring of Outpatient Parenteral Antimicrobial Therapy (OPAT) and Selected Oral Antimicrobial Agents – Adult – Inpatient/Ambulatory – Clinical Practice Guideline

Appendix A. Coordinating an OPAT Discharge

From: Clinical Monitoring of Outpatient Parenteral Antimicrobial Therapy (OPAT) and Selected Oral Antimicrobial Agents – Adult – Inpatient/Ambulatory – Clinical Practice Guideline

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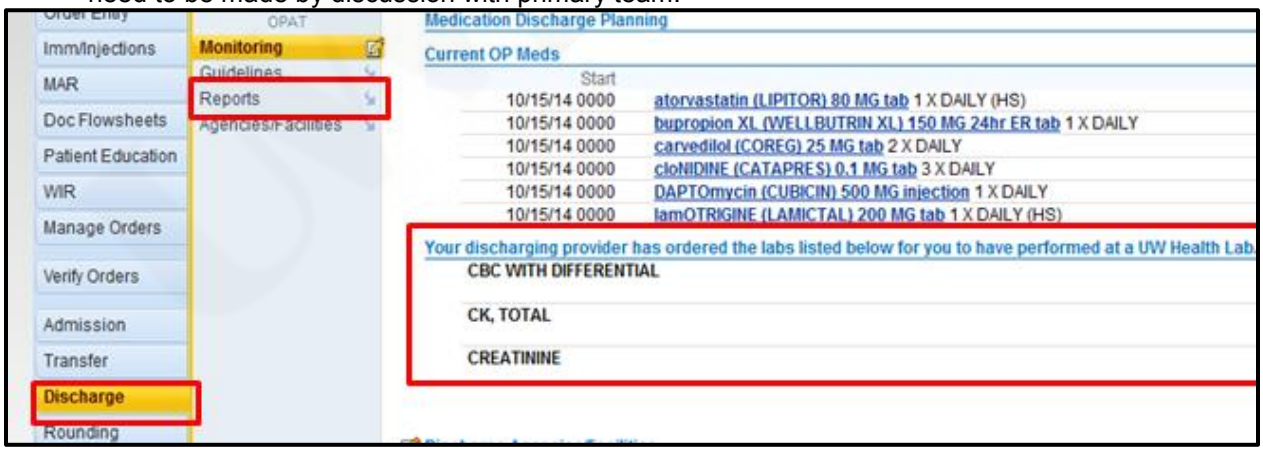
OPAT discharge navigator and laboratory monitoring

- Select OPAT button for ALL patients that discharge on intravenous antimicrobials

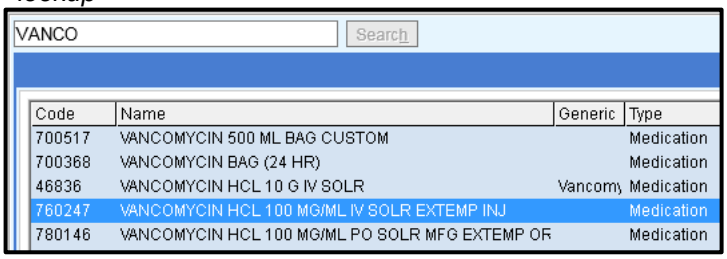
- Confirm team has ordered appropriate labs
  - Labs should appear in the OPAT monitoring navigator if they are ordered through UWHealth. If ordered outside of UWHealth, labs will not appear in this section and confirmation of ordering will need to be made by discussion with primary team.

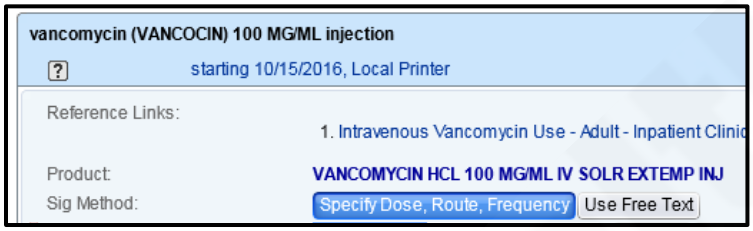


- Compare ordered labs to OPAT Guideline and ID consult note (if available)
- Ask team to order any missing labs (lab ordering is the responsibility of the provider)
- Confirm date for first outpatient drug level (if necessary) by communicating with infusion agency
  - Some Home Health nurses can only draw labs on certain days; discuss with infusion agency to confirm most appropriate time for first outpatient drug level
- Select "laboratory monitoring has been reviewed" button in HealthLink

Preparing OPAT prescriptions

- Ensure team orders **drug for injection** on discharge
  - *Discharge Navigator → Order Reconciliation → New Med Orders for Discharge tab → Database lookup*





  - Do NOT order the drug in a base fluid. The infusion agency will put the drug in the most appropriate fluid and concentration for home stability when the infusion agency pharmacists receive the prescription.
- Round dose to nearest 10 mg for daptomycin
- Change dispense quantity to "1 each"
- Change refills to "PRN" even if duration is known
  - This allows the infusion agency to re-dispense drug if patients have storage issues or malfunctions while dispensing at home
- If duration is known, add anticipated stop date as a note in Discharge Medication List and discharge hand-off note
- Print prescription for fax; fax to infusion agency
- Include the name of the provider who will follow the patient after discharge in the discharge hand-off note

Contacting Home Infusion Agency

- Look at social work or Chartwell note in HealthLink for fax numbers, contact information, or planning information
- Chartwell nurses are available during business hours at UW University Hospital
- Chartwell main office: 608-831-8555
  - Can speak to pharmacist during business hours for drug or dosing questions
  - Can ask to speak with on-call pharmacist after-hours or on weekends
- Paging (2-2122 or 262-2122) can assist in contacting a home infusion agency

Clinical considerations for home infusions

(All recommendations: *UW Health Strong Recommendation, Moderate Quality of Evidence*)

- Try to avoid checking inpatient drug troughs on the day of discharge if possible
  - Infusion agencies process orders and prepare the first home dose the morning of discharge; pending troughs will delay care
- It is preferred to administer drugs at home over short infusions or IV push to significantly decrease amount of time patient is connected to pump
  - Improves ability to fit into work/life/sleep schedule

- Enhances adherence
- All antimicrobials can be administered via Rateflow short infusion (small-volume admixture connected to IV pole) EXCEPT nafcillin/oxacillin and penicillin G
- The following antimicrobials can be administered via IV push or Freedom 60 pump by Chartwell (other home infusion agencies may have different practices), avoiding the need to be connected to an IV pole:

Amikacin**	Ceftazidime	Meropenem*
Aztreonam	Ceftriaxone	Nafcillin *
Cefazolin*	Cefuroxime	Oxacillin *
Cefepime*	Clindamycin**	Piperacillin-tazobactam *
Cefotaxime	Daptomycin	Tobramycin**
Cefotetan	Gentamicin**	Vancomycin***
Cefoxitin		

* IV push available, however, prolonged infusion is the preferred method of administration
** 30-60 minute infusion on Freedom 60 pump, no IV push available
*** 60-90 minute infusion on Freedom 60 pump, no IV push available

- Factors that prohibit short infusions or IV push antibiotics with OPAT may include (but are not limited to):
  - Accepting facility or patient family unable to perform multiple administrations daily
  - Patient inability to complete short infusion or IV push independently
  - Therapeutic inferiority with short infusion (i.e. therapeutic superiority with prolonged infusion or continuous infusion)
- The following antimicrobials have frequent dosing intervals and can therefore be made in a 24-hour bag by Chartwell (other home infusion agencies may have different practices), which can be given as continuous infusion or programmed on a pump that fires intermittent doses from the same bag:

Acyclovir	Cefotetan	Ceftolozane-tazobactam *
Ampicillin	Cefoxitin	Meropenem **
Aztreonam	Ceftazidime	Nafcillin *
Cefazolin	Cefuroxime	Oxacillin *
Cefepime	Clindamycin	Penicillin G potassium *
Cefotaxime	Doripenem	Piperacillin-tazobactam *
Vancomycin		

* Continuous infusion is the preferred method of administration
** Must change bag after 12 hours instead of 24 hours

- Ampicillin-sulbactam does not have good home stability and cannot be given as a 24-hour bag
  - Patients or caregivers have to be willing and able to administer this medication multiple times a day
- Some SNFs or Home Health agencies cannot run extended infusions, cannot administer medications every 6 hours, and/or cannot hook patients up to 24-hour pumps
  - This is rare, but can create difficulty if it occurs. Attempt to confirm this before discharge day.
  - The dosing for extended beta-lactam infusions and intermittent/short infusions may be different. See the Renal Function-Based Dose Adjustments Clinical Practice Guideline and the Pharmacokinetic/Pharmacodynamic Dose Optimization of Antibiotics for the Treatment of Gram-negative Infections Clinical Practice Guidelines
- If antimicrobial infusion cost is preventing discharge to home or to other facility, work with attending team and/or Infectious Disease service to identify if other antimicrobial choices may facilitate discharge

Antimicrobial Drug for Injection Medication Record Numbers (ERx)

Antimicrobial	ERx for OPAT Injection Database Lookup (F7)	Concentrations or Strengths
Liposomal amphotericin	58058	50 mg
Acyclovir	44030	500 mg
Amikacin	760007	250 mg/mL
Ampicillin	34543	1 g
	34546	2 g
Ampicillin-sulbactam	50601	1.5 g
	50599	3 g
Azithromycin	57146	500 mg
Aztreonam	44264	1 g
	44265	2 g
Caspofungin	66233	50 mg
	66234	70 mg
Cefazolin	35636	1 g
Cefepime	52161	1 g
	52163	2 g
Cefoxitin	44555	1 g
	44557	2 g
Ceftazidime	44571	500 mg
	44568	1 g
	44570	2 g
Ceftriaxone	44581	1 g
	44582	2 g
Cefuroxime	35657	750 mg
	35655	1.5 g
Ciprofloxacin	144939	200 mg/ 20 mL
	144940	400 mg/ 40 mL
Clindamycin	119041	300 mg/ 2 mL
	119039	600 mg/ 4 mL
	119040	900 mg/ 6 mL
Daptomycin	73977	500 mg
Doripenem	143475	250 mg
	126526	500 mg
Ertapenem	68678	1 g
Ganciclovir	45226	500 mg
Gentamicin	37859	10 mg/mL
	37860	40 mg/mL
Levofloxacin	54892	25 mg/mL
Linezolid	170913	200 mg/ 100 mL
	170914	600 mg/ 300 mL
Meropenem	53238	500 mg
	53239	1 g
Micafungin	107268	50 mg
	115014	100 mg
Nafcillin	39988	1 g
	39990	2 g
	39989	10 g
Oxacillin	40651	1 g
	40653	2 g
	40652	10 g

Antimicrobial	ERx for OPAT Injection Database Lookup (F7)	Concentrations or Strengths
Penicillin G Potassium	40825	5,000,000 units
	40824	20,000,000 units
Penicillin G Sodium	40826	5,000,000 units
Piperacillin-tazobactam	54253	2.25 g
	54252	3.375 g
	54251	4.5 g
Rifampin	46481	600 mg
Sulfamethoxazole-trimethoprim	42456	400-80 mg/ 5 mL
Tigecycline	107987	50 mg
Tobramycin	760239	40 mg/mL
	104635	80 mg/ 2 mL
Vancomycin	43437	500 mg
	135474	750 mg
	43436	1000 mg
Voriconazole	69968	200 mg