KY Antimicrobial Stewardship Innovation Consortium

Clinical Practice Review

Antimicrobial IV to PO Switch Practices at 9 Institutions in Kentucky with Established Antimicrobial Stewardship Programs

On behalf of the Kentucky Antimicrobial Stewardship Innovation Consortium (KASIC) Advisory Board

Intravenous (IV) to oral (PO) transition of antimicrobial therapy is a common antimicrobial stewardship activity for which many health systems have developed guidelines and protocols. The antimicrobial stewardship experts in Kentucky provide guidelines and protocols used at their institutions and summarize trends, which may help others create or enhance local practices.

Introduction

Intravenous (IV) route for antimicrobial therapy is commonly utilized for patients hospitalized with infections because of higher and faster peak serum concentrations in comparison to the oral (PO) route. Although IV therapy provides a pharmacokinetic benefit, it carries risks such as phlebitis, thrombosis, extravasation, and infections and PO antibiotics are clinically effective.[1] Switching to PO therapy in the hospital has been associated with shorter length of stay, increased patient satisfaction, and cost savings.[1-3] To realize these benefits, many institutions develop IV to PO switch practices to support medication route conversion for patients meeting certain clinical parameters. This is often done by clinical pharmacists.[5] The IV to PO switch practices may be outlined in the form of a protocol or a guideline. An IV to PO protocol is a policy which allows the switch to occur in a patient meeting pre-specified criteria without an explicit provider order. In contrast, a guideline is a document which gives recommendations or best practices regarding IV to PO switch, but requires a discussion of the recommendation with a provider and provider approval is necessary to change the medication route. Various institutions across the state of Kentucky have implemented robust IV to PO switch practices; however, numerous facilities currently operate with minimal or no IV to PO switch guidance. Hospitals may benefit from a review of IV to PO switch practices at institutions in Kentucky, and ultimately use this to enhance current practice or create new guidelines or protocols. The purpose of this document is to summarize IV to PO switch practices utilized by healthcare institutions with established antimicrobial stewardship programs across Kentucky.

Methods

The Kentucky Antimicrobial Stewardship Innovation Consortium (KASIC) strives to improve antibiotic use across Kentucky and includes an Advisory Board which consists of pharmacists who practice in established antimicrobial stewardship programs at their institutions. KASIC invited the Advisory Board to share their current IV to PO switch

practices. The documents were evaluated in a systematic approach and the information was collated to demonstrate similarities and differences.

Results

Nine of the ten institutions represented by the KASIC Advisory Board submitted their IV to PO switch practices for analysis. The Appendix contains the submitted documents in an abbreviated format which includes only sections relevant to antimicrobials. The protocols in the Appendix are listed in no particular order. There was substantial variation in the characteristics of institutions that submitted their documents. The types of institutions included community hospitals, academic medical centers, and long-term acute care hospitals. Additionally, some protocols submitted were utilized by large health systems that included more than one hospital. The number of licensed beds of contributing hospitals ranged from approximately 100 beds to more than 800 beds (Figure 1).

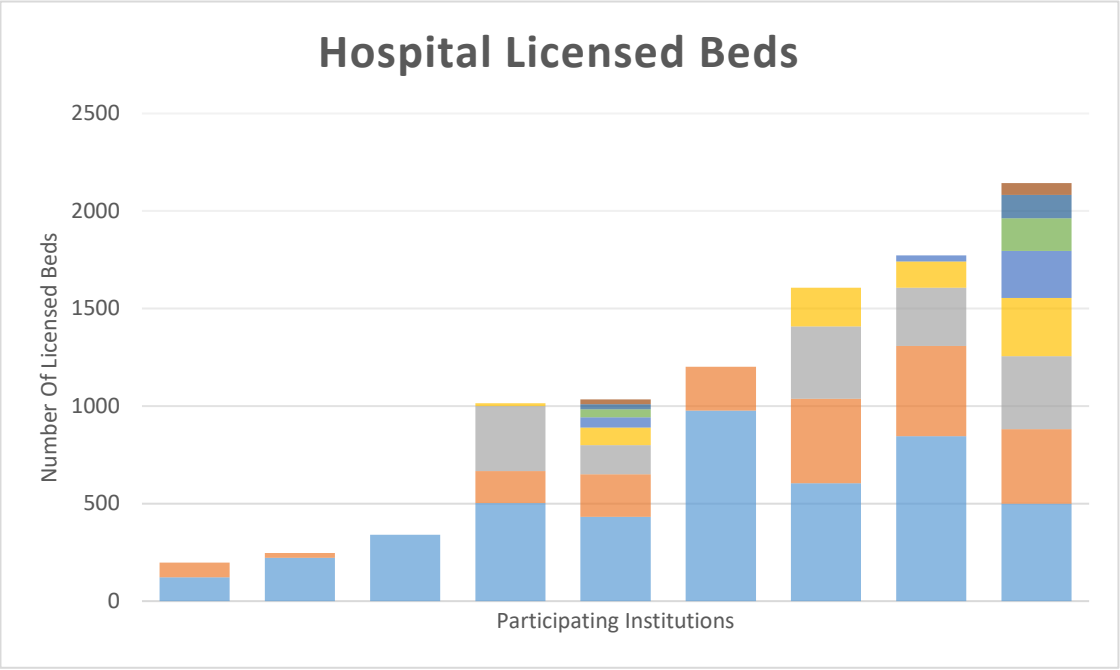

Figure 1. **Number of licensed beds of contributing hospitals.** Each stacked column represents one institution or health system. Colored sections within the column represent different hospitals within the system.

All institutions utilized protocols which gave pharmacists authority to convert antimicrobial therapy from IV to PO without a provider order if pre-specified criteria outlined in the protocol were met. Protocols differed in terms of which antimicrobials were eligible for conversion and the criteria required for conversions to occur. Specific antimicrobials eligible for conversion at institutions are shown in Figure 2. Of note, some protocols included conversion of antimicrobials that involved different drugs for the IV and PO counterparts, namely within the β-lactam class of antibiotics. This included IV ampicillin/sulbactam to PO amoxicillin/clavulanate, IV ampicillin to PO amoxicillin, IV oxacillin to PO dicloxacillin, IV cefazolin to PO cephalexin, and IV ceftriaxone to PO cefdinir.

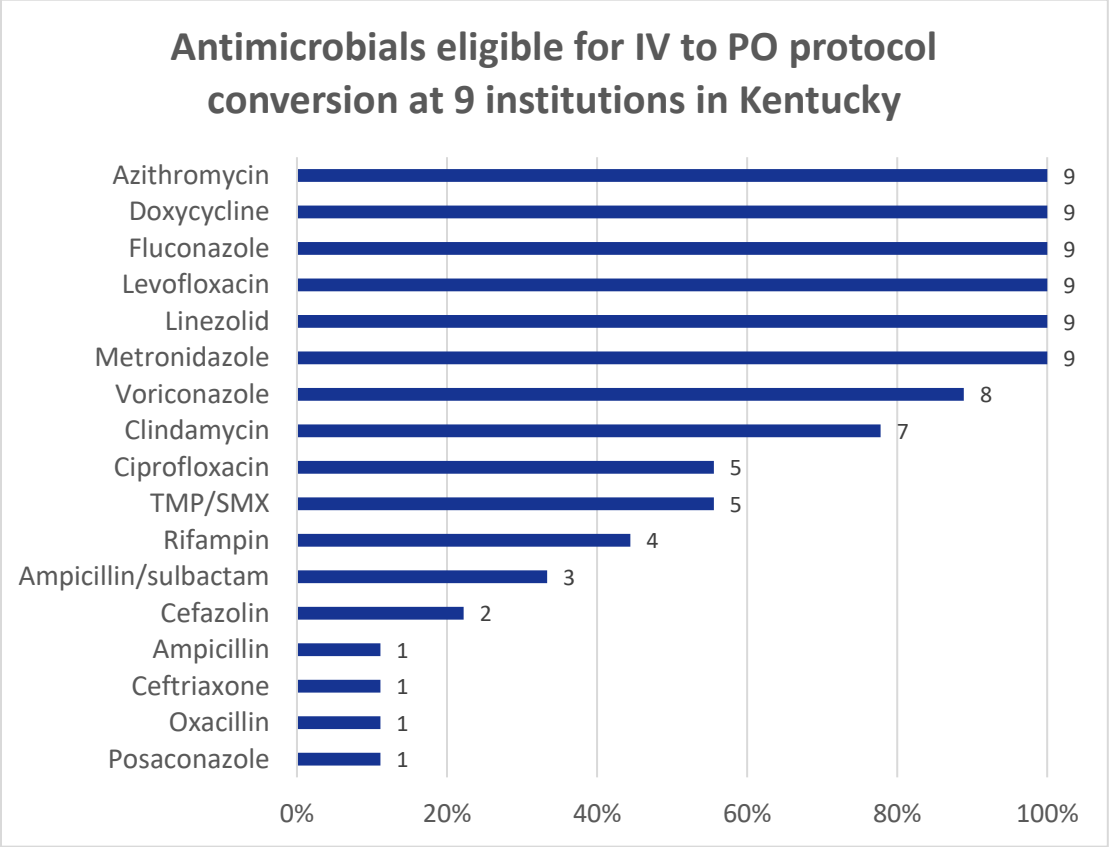

Figure 2. **Percent and number of institutions with antimicrobial included in IV to PO protocol.** Abbreviations: TMP/SMX, trimethoprim/sulfamethoxazole.

The protocols varied in the level of guidance provided for implementation of conversions, specifically regarding conversion doses and ratio/bioavailability information. Four of nine (44%) institutions had both conversion doses and ratio/bioavailability information listed in the protocol, two of nine (22%) had one of these pieces of information, and 3/9 (33%) had neither.

Each protocol listed either inclusion criteria, exclusion criteria, or both. The most common consideration was related to patients' ability to receive medications via the enteral route (taking other PO medications, tolerating diet, etc). Other criteria such as clinical stability or infection type were addressed by some, but not all of the protocols (Figure 3). Specific examples of inclusion and exclusion criteria utilized are listed in Table 1 and 2. The various combinations of inclusion and exclusion criteria utilized by each protocol are shown in the Appendix.

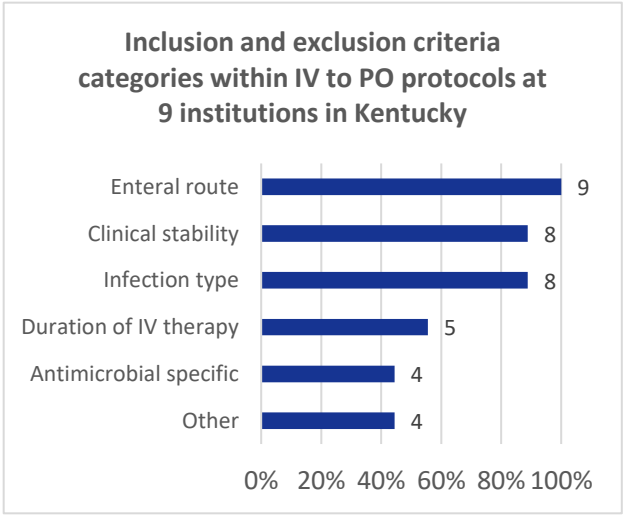

Figure 3. **Percent and number of institutions with certain inclusion and exclusion criteria categories.**

Table 1. Examples of specific criteria for inclusion or exclusion by category

Inclusion/Exclusion Category	Specific Examples of Inclusion or Exclusion Criteria
Enteral Route	No condition interfering with absorption (e.g. diarrhea >5 liquid stools/day, gastrointestinal bleed, nasogastric tube suction, short bowel syndrome, chronic motility disorder, malabsorption syndrome, gastrointestinal obstruction, ileus), no nausea and/or vomiting in last 12-24 hours (e.g. antiemetics administration), taking other oral medications, food, and/or enteral feeds, not refusing oral medications, no surgery scheduled in the next 24 hours
Clinical Stability	No sepsis, no vasopressors, hemodynamically stable, clinical status improvement, afebrile for 8-24 hours or temperature decreasing, white blood cell count normalizing (>10% reduction from baseline) or can be explained by non-infectious reason (e.g. steroids)
Infection type	Excludes central nervous system infection, endocarditis, necrotizing skin and soft tissue infections, bone and joint infections, invasive fungal infections, toxic megacolon, febrile neutropenia, cystic fibrosis exacerbation, empyema, undrained abscess, *Staphylococcus aureus* bacteremia
Duration of IV Therapy	Received at least 24-48 hours of IV therapy with or without exceptions such as urinary tract infection, skin and soft tissue infection, prophylaxis
Antimicrobial specific	See Table 2
Other	Excludes patients on immunosuppressant treatment for HIV, cancer, organ transplant (not steroids), neutropenia, infectious diseases physician consulted, pediatric patients

Table 2. Examples of antimicrobial specific inclusion or exclusion criteria

Antimicrobial	Specific Examples of Inclusion or Exclusion Criteria
Ampicillin/sulbactam	Includes one of the following: lower respiratory tract infection, otitis media, sinusitis, skin and soft tissue infections, urinary tract infections. Excludes non-respiratory infections, bacteremia, empyema, *Acinetobacter* spp.
Cefazolin	Includes one of the following: respiratory tract infection, otitis media, skin and soft tissue infections, urinary tract infections, bone infections
Ceftriaxone	Includes one of the following: community acquired pneumonia, upper respiratory tract infection, sinusitis, uncomplicated skin and soft tissue infections, urinary tract infections
Clindamycin	Excludes doses >600 mg
Doxycycline	Excludes patients on tube feeds
Fluoroquinolones	Excludes patients on tube feeds
Metronidazole	Excludes severe or complicated *Clostridioides difficile* infection (e.g. megacolon, ileus)
Oxacillin	Excludes endocarditis, osteomyelitis
Voriconazole	Includes patients on a maintenance dosing regimen

Discussion

This review identified that most institutions with established antimicrobial stewardship programs in Kentucky have IV to PO protocols, which are implemented by pharmacists per protocol without a specific order from a provider. The contents of the protocols differed by the type of antimicrobials eligible for conversion, clinical eligibility criteria, and level of guidance provided for implementation of the protocol.

There were several antimicrobials which all institutions had on their respective IV to PO protocols (Figure 2). However, others were not universally represented. Reasons for this may include niche indications/low utility (e.g. posaconazole) or lack of direct equivalent PO option (e.g. ampicillin/sulbactam). Switching from an IV formulation to PO of the same antibiotic is fairly straight forward once the correct dose is chosen. However, it is notable that several institutions allow for conversion of certain IV agents which do not have an equivalent PO formulation or do not have a PO formulation with adequate bioavailability. In these cases, the conversion is performed to a PO agent within the same class as the IV agent. Caution should be used since route conversion may not result in equivalent antibiotic exposure. An example of this would be conversion from IV ceftriaxone to PO cefdinir, which has an estimated oral bioavailability of only up to 25%.[6] Care should be taken when determining which patients are eligible for such conversions and the decision should take into account infection source and severity. In the future, this practice may pave the way to more innovative ways to perform routine IV to PO conversions, such as inter-class switch to an agent with a similar spectrum of activity or perhaps even de-escalation of spectrum in select patients.

The majority of institutions provided guidance on dose or IV to PO conversion ratios to be used when switching patients. Having this information readily accessible allows pharmacists to appropriately convert IV antimicrobials to the equivalent PO formulation. This is particularly relevant for antimicrobials which do not have one to one conversion or require transitioning from a weight-based dose to fixed dose.

Another important aspect of IV to PO protocols is determining which patients may be appropriately switched. No protocol was alike in terms of the specific inclusion and exclusion criteria used to identify patients who are appropriate for a switch. Some institutions were more specific and restrictive than others. The authors did not attempt to develop best practices for IV to PO protocols within the scope of this manuscript given that local prescribing culture heavily influences what type of IV to PO switch strategy may be viable. The optimal eligibility criteria are typically chosen based on a consensus from an institution's clinical leadership and feasibility of implementation of such criteria.

This review serves to disseminate information on IV to PO switch practices utilized by institutions with established antimicrobial stewardship programs in Kentucky. Although the adherence rates to the protocols and associated outcomes are unknown, this summary provides a starting point for institutions seeking to start an IV to PO program or enhance an existing program. IV to PO switch practices should be tailored to the institution's needs, clinical decision-making culture, and feasibility.

References

1. Dychter SS, Gold DA, Carson D, Haller M. Intravenous therapy: a review of complications and economic considerations of peripheral access. *J Infus Nurs*. 2012; 35(2):84-91.

2. Ramirez JA, Vargas S, Ritter GW, et al. Early switch from intravenous to oral antibiotics and early hospital discharge: a prospective observational study of 200 consecutive patients with community-acquired pneumonia. *Arch Intern Med.* 1999;159(20):2449-54.

3. Bamford, KB, Desai M, Aruede MJ, Lawson W, Jacklin A, Franklin BD . Patients' views and experience of intravenous and oral antimicrobial therapy: room for change. *Injury.* 2011; 42 Suppl 5:S24-7.

4. Azamgarhi T, Shah A, Warren S. Clinical experience of implementing oral versus intravenous antibiotics (OVIVA) in a specialist orthopedic hospital. *Clin Infect Dis*. 2021; 73(9):e2582-8.

5. Cyriac JM, James E. Switch over from intravenous to oral therapy: A concise overview. *J Pharmacol Pharmacother*. 2014; 5(2):83-7.

6. Cefdinir capsules [prescribing information]. Parsippany, NJ: Ascend Laboratories, LLC; June 2022.

Appendix

PROTOCOL 1

PURPOSE:

To maximize patient care and minimize the risks and costs associated with intravenous (IV) therapy when an equivalent oral (PO) dosage form is available, and the oral/enteral route is feasible based on the patient's clinical conditions.

DEFINITIONS:

Switch Therapy – refers to the practice of switching a medication from IV therapy to PO therapy as soon as a patient is clinically stable. Medications that are targeted for switch therapy are PO drugs that either produce serum levels comparable to the parenteral form or are appropriate based on clinical guidelines and medication half-life. Switch therapy can reduce the length of hospitalization and lower associated costs.

POLICY STATEMENTS:

I. Pharmacists may use established criteria to evaluate medications for conversion to PO therapy. (Refer to attachment for a complete list of specific medications pertaining to this policy). If the patient is determined to be a candidate for switch therapy, a pharmacist may change the medication per recommended dosing guidelines.
II. Ordering providers may exclude a patient's IV medication from the IV to PO conversion policy by indicating, "Do not adjust dose" or "Do not substitute" (or other similar statement). These exclusions may be referred to the Pharmacy & Therapeutics Committee (P&T) for review.

PROCEDURES:

A. Pharmacists use the following conversion guidelines:
    a. Inclusion Criteria – IV to PO conversion may be considered when a patient meets the following parameters:
        i. Patient is clinically improving
        ii. Functioning gastrointestinal (GI) tract
        iii. Tolerates at least a clear liquid diet or > 50% of goal enteral feedings
        iv. Able to take PO or per tube medications
        v. Antimicrobial-specific criteria:
            1. Afebrile for at least 8 hours
            2. Signs and symptoms of infection are improving
            3. White blood cell (WBC) count is normalizing (≥ 10% reduction from baseline), or WBC can be explained by non-infectious reason (e.g., steroids)
    b. Exclusion Criteria – Exclusion from IV to PO conversion occurs under the following circumstances:
        i. Inability to swallow and no enteral access
        ii. Nothing by mouth (NPO) status and not receiving PO medications

iii. Active GI bleed
iv. Condition interfering with absorption of oral medications (e.g., diarrhea greater than 5 liquid stools/day, short bowel syndrome, GI obstruction – ileus or suspected ileus with no active bowel sounds, vomiting)
v. Septic within last 24 hours or on significant vasopressor support to maintain mean arterial pressure (MAP)
vi. Suspected or confirmed meningitis or other severe central nervous system infection, endocarditis, bone and joint infections, toxic megacolon, febrile neutropenia, cystic fibrosis exacerbations or undrained abscess/empyema (antimicrobial specific)

c. Patients who are scheduled to go to surgery within 24 hours are excluded until after surgery and re-evaluated once feeds and/or oral meds have been restarted

B. If the patient is determined to be candidate for IV to PO conversion therapy per the above guidelines, the pharmacist:
   a. Initiates the appropriate change order in the patient's medical record "Per Pharmacy & Therapeutics Policy," considering the pharmacokinetic and pharmacodynamic properties of the drug when selecting the appropriate dose and dosing interval. For drugs that should be administered on an empty stomach and the patient is receiving tube feeds, includes in the order instructions to hold tube feeds as indicated in the policy and consults Nutrition Services to adjust the feeding rate.
   b. Documents IV to PO conversion in the pharmacy's clinical documentation system

REFERENCES:

1. Kuper, Kristi M. "Intravenous to Oral Therapy Conversion." Competence Assessment Tools for Health system Pharmacists. 4th ed. Bethesda: American Society of Health system Pharmacists, 2008. 347-60. Web.
2. Lexicomp Online Database. Accessed November 2017.
3. Micromedex Online Database. Accessed November 2017.
4. Clinical Pharmacology Database. Accessed November 2017.
5. TJC MM.05.01.01

IV TO PO CONVERSION GUIDE:

Drug	IV Dose	PO Dose	Oral Bioavailability	Notes
Azithromycin	250 mg 500 mg	1:1 conversion	40%	Is recommended due to long half-life (68-72 hours)
Ciprofloxacin	400 mg q8-12h 200 mg q8-12h	500 mg q12h 250 mg q12h	70%	Requires temporal spacing
Clindamycin	600 mg 900 mg	300 mg 450 mg	90%	Dosing highly dependent on indication
Doxycycline	100 mg	100 mg	100%	Requires temporal spacing
Fluconazole	100 mg 200 mg 400 mg 800 mg	1:1 conversion	>90%	
Levofloxacin	250 mg 500 mg 750 mg	1:1 conversion	99%	Requires temporal spacing
Linezolid	600 mg	600 mg	100%	
Metronidazole	500 mg	500 mg	80%	Policy excludes toxic megacolon. Avoid alcohol containing products during therapy and three days after therapy.
Rifampin	300 mg 600 mg	1:1 conversion	90%	
Trimethoprim/ Sulfamethoxazole (TMP/SMX)	5-15 mg/kg TMP/day in 3-4 doses	1:1 conversion	90-100%	For oral, round dose to accommodate nearest tablet size available.
Voriconazole	LD: 6 mg/kg q12h X2; MD: 4 mg/kg q12h	1:1 conversion	96%	For oral, round dose to accommodate nearest tablet size available. For obesity (>130% IBW), consult with prescriber.

Switch Therapy Conversion					
IV Drug	**IV Dose**	**PO Drug**	**Usual PO Dose**	**Oral Bioavailability**	**Notes**
Ampicillin	1-2 g q4-6h	Amoxicillin	500 mg q8h	100%	
Ampicillin/ sulbactam	1.5-3 g q6h	Amoxicillin/ clavulanate	875 mg q12h	90%	Must first verify susceptibility
Cefazolin	1-2 g q6-8h	Cephalexin	500 mg q6h	90%	

Tables are not inclusive of all dosage regimens, but serve to simplify and guide conversations. Dosing is subject to change based on individualized clinical status.

REFERENCES:

1. Kuper, Kristi M. “Intravenous to Oral Therapy Conversion”. Competence Assessment Tools for Health System Pharmacists 4th ed.
2. Bethesda: American Society of Health System Pharmacists, 2008. 347-60. Web.
3. Lexicomp Online Database. Accessed September 2015.
4. Micromedex Online Database. Accessed October 2015.
5. Clinical Pharmacology Database. Accessed July 2016.

PROTOCOL 2

BACKGROUND:

In hospitalized patients, the IV route for antimicrobials or antifungals is required for those who are seriously ill, need antibiotics with poor bioavailability, or have infections at difficult to penetrate sites. In other patients, drugs with excellent oral bioavailability may be switched to the oral route while delivering equivalent therapy. This early switch to oral medications may result in improved outcomes including lower drug costs, reduced need for and duration of intravenous access, potentially reduced line associated infections, and shortened length of stays without affecting quality of care. The modifications of the inclusion/exclusion criteria below are designed to streamline the process to maximize the IV to PO potential.

ELIGIBILITY CRITERIA:

A. Inclusion
    a. Patient has received a minimum of 24 hours of IV therapy
        i. Exception: those receiving therapy for UTI, skin or skin structure infection, or prophylaxis (don't have to wait till 24 hours)
    b. Patient tolerating at least a clear liquid diet or enteral feedings
    c. Patient is tolerating other oral or per tube medications
    d. Conversion of ampicillin/sulbactam to amoxicillin/clavulanate is exclusive to patients being treated for respiratory tract infections
B. Exclusion
    a. Patients with central nervous system infections including meningitis, endovascular infections including endocarditis, necrotizing soft tissue infections, or on vasopressors
    b. Patients with gastrointestinal pathology that may interfere with adequate absorption (such as gastroparesis, ileus, proximal resection of small bowel)
    c. Patients with vomiting (i.e. receiving antiemetics) in last 24 hours or severe mucositis
    d. Antibiotic specific exclusions
        i. Metronidazole: Patients with severe/complicated *Clostridium difficile* infection (e.g. megacolon, ileus)
        ii. Fluoroquinolones and doxycycline: Patients receiving continuous tube feeds
        iii. Clindamycin: Patients receiving doses > 600 mg
        iv. Ampicillin/sulbactam → amoxicillin/clavulanate: Patients with any of the following:
            1. Empyema
            2. Bacteremia
            3. Cultures positive for *Acinetobacter* spp

IV TO PO CONVERSION GUIDE:

Drug	IV Dose	PO Dose	Oral Bioavailability	Notes
Azithromycin	250-500 mg Q24H	250-500 mg Q24H	52%	1:1
Ciprofloxacin	400 mg Q8H 400 mg Q12H 200 mg Q12H	750 mg Q12H 500 mg PO Q12H 250 mg PO Q12H	80%	Adjust per indication and renal function, separate from cation containing meds Exclusion: Continuous tube feeds
Clindamycin	600 mg Q8H 300 mg Q8H	600 mg TID/450 mg QID 300 mg TID	90%	1:1, if unable to tolerate 600 mg dose, can do 450 mg Q6H Exclusion: Doses ≥ 900 mg
Doxycycline	100 mg Q12H	100 mg BID	100%	1:1, separate from cation containing meds Exclusion: Continuous tube feeds
Fluconazole	100-400 mg Q24H	100-400 mg Q24H	>90%	1:1, adjust per indication and renal function
Levofloxacin	250-750 mg Q24H	250-750 mg Q24H	99%	1:1, adjust per indication and renal function, separate from cation containing meds Exclusion: Continuous tube feeds
Linezolid	600 mg Q12H	600 mg BID	100%	1:1
Metronidazole	500 mg Q8H	500 mg TID	100%	1:1 Exclusion: Severe/complicated CDI
Posaconazole	300 mg Q24H	Tablet: 300 mg Q24H Suspension: 200 mg TID	54%	1:1, tablet cannot be crushed
Rifampin	300 mg Q8H	300 mg TID	>90%	1:1
Trimethoprim/ sulfamethoxazole	5-20 mL (5 mL= 80 mg TMP)	5 mL IV = 1 SS tab 10 mL IV = 1 DS tab	100%	1:1, round to nearest whole tablet, adjust per indication and renal function
Voriconazole	100-400 mg Q12H	100-400 mg BID	96%	1:1
Ampicillin/sulbactam → amoxicillin/clavulanate	3 gm IV Q6H	875/125 mg PO BID	N/A	Adjust per renal function Respiratory tract infections only Exclusions: Bacteremia, empyema, or cultures growing *Acinetobacter* spp

PROTOCOL 3

PURPOSE:

The purpose of this program is to facilitate prompt conversion to more cost-effective oral regimens as soon as the patient is able to or is already taking medications by mouth.

RESPONSIBILITY:

Pharmacists

POLICY:

Pharmacists will screen targeted drugs with high oral bioavailability for opportunity to convert intravenous therapy to oral forms per established criteria. If criteria are met, pharmacist will write an order in the patient's medical record or electronically enter an order into their electronic medical record to convert the therapy to the oral form.

Many drugs have an oral bioavailability ≥ 90%. The intravenous forms of these agents are useful in situations where the patient may have compromised gastrointestinal function. However, in cases where the patient is in need of continued therapy but is clinically stable with a functioning GI tract, oral therapy is a viable and preferred option.

The purpose of this program is to facilitate prompt conversion to more cost effective oral regimens as soon as the patient is able to or is already taking medications by mouth.

The following agents will be screened for the automatic IV to PO conversion program:

Azithromycin	Fluconazole	Metronidazole
Clindamycin	Levofloxacin	Trimethoprim/sulfamethoxazole
Doxycycline	Linezolid	Voriconazole

PROCEDURE:

A. Pharmacist role
    a. Clinical pharmacists will generate a daily list of patients receiving the targeted intravenous agents.
    b. Patients will be evaluated by the clinical pharmacist for appropriateness of continued intravenous therapy.
    c. After 24 hours of IV therapy, patients will be transitioned from intravenous to oral therapy if they meet the following criteria:
        i. Functioning gastrointestinal tract
        ii. Receiving other oral medications
        iii. Patient is clinically improving or stable
        iv. For anti-infective agents, the patient's temperature is decreasing or patient is afebrile (temperature <100.4 F) for at least 24 hrs
        v. No evidence of active ongoing GI bleeding
    d. Patients would be excluded based on the following:

i. Patients who had vomiting in last 12 hrs, continuous NG suction, short bowel syndrome or history of chronic motility disorder of GI system
ii. Patients with Grade Ill or IV mucositis (per progress note or H&P)
iii. Patients for which IV therapy is required to resolve disease or additional specific criteria must be met prior to switching therapy (e.g. meningitis, endocarditis, osteomyelitis, sepsis, invasive fungal infections)
iv. Patients on high dose vasopressors or shock state (that would decrease enteric absorption)

e. If criteria are met, pharmacist will electronically enter an order into the patient's electronic medical record to convert the therapy to the oral form per protocol
f. The oral therapy will be started with the next scheduled IV dose if no interactions will result at that time, and the IV formulation discontinued

B. Provider role
a. Providers may reinstate IV form if the patient's clinical status changes to where exclusion criteria exist
b. Providers may indicate clinical necessity of IV formulations for patients to be excluded from oral conversion

PROTOCOL 4

PURPOSE:

To provide guidelines for substitution of intravenous administration to oral/enteral administration in adult patients.

POLICY:

The pharmacy department will automatically substitute appropriate adult patients based on approved criteria from the intravenous to oral/enteral (IV to PO) administration with the goal of providing good patient care that is cost effective.

PROCEDURE:

A. Pharmacists should review patients on selective IV medications within 24 hours after initiation of therapy for possible IV to PO/enteral substitution
B. The following mediations are approved for Pharmacist initiated IV to PO switching:

Azithromycin	Fluconazole	Quinolones (patient must not be on tube feeding)
Clindamycin (600 mg or less)	Linezolid	
Doxycycline	Metronidazole	Voriconazole

C. Criteria for IV to PO switching:
    a. On therapy for 24 hours
    b. Functioning GI tract
    c. Hemodynamically stable
    d. Showing signs of clinical improvement
    e. Taking other oral medication or enteral diet
D. Patients will be excluded from switching if they have or are suspected to have one of the following:
    a. Sepsis
    b. Osteomyelitis
    c. CNS infection
    d. Septic arthritis
    e. Endocarditis
E. The Pharmacist will change the IV medication to the equivalent PO/enteral dose
F. The Pharmacist will write or enter an electronic order indicating the substitution was made
G. The Physician may override the decision. This will be noted in the patient's medication profile.

PROTOCOL 5

IV to PO conversion can be initiated by the pharmacist as long as certain parameters in in place.

ELIGIBILITY CRITERIA:

C. Inclusion
    a. Patient tolerates food, PO fluids, or enteral feedings
    b. Patient has received IV anti-infectives for at least 48 hours
D. Exclusion
    a. Patient refuses to take oral dose
    b. Patient has esophageal incompetence
    c. Severe nausea/vomiting present
    d. Patient has malabsorption syndrome, inflammatory bowel disease, or short bowel syndrome
    e. Patient has spiked a temp within the past 24 hours
    f. Patient is receiving immunosuppressant treatment for HIV, cancer or organ transplantation. (Does not include steroids such as prednisone).
    g. Patient is neutropenic (neutrophils <100 cells/mm3 or ANC <500)
    h. Patient is septic
    i. Patient has osteomyelitis, endocarditis, or meningitis

IV TO PO CONVERSION GUIDE:

IV Drug and Dose	PO/Enteral Drug and Dose
Azithromycin	Azithromycin same dose and frequency
Ciprofloxacin 400 mg	Ciprofloxacin 500 mg same frequency
Clindamycin 300mg q8h	Clindamycin 300 mg q6h
Clindamycin 600mg q8h	Clindamycin 450mg q6h
Clindamycin 900mg q8h	Clindamycin 450mg q6h
Doxycycline	Doxycycline same dose and frequency
Fluconazole	Fluconazole same dose and frequency
Levofloxacin	Levofloxacin same dose and frequency
Linezolid	Linezolid same dose and frequency
Metronidazole	Metronidazole same dose and frequency
Oxacillin (except endocarditis and osteomyelitis)	Dicloxacillin 500mg q6h
Rifampin	Rifampin same dose and frequency
Trimethoprim/sulfamethoxazole	Trimethoprim/sulfamethoxazole equivalent dose
Voriconazole	Voriconazole same dose and frequency

PROTOCOL 6

The P&T Committee has approved a procedure for converting patients on designated medications from IV to PO based on specific criteria. The medications were chosen based on the bioavailability of the agent and documented efficacy when given IV and PO. The medications approved for the conversion are listed below along with equivalent doses.

ELIGIBILITY CRITERIA:

A. Inclusion
    a. Patient has functioning GI tract
    b. Patient taking other PO medications (if applicable)
    c. Patient clinical status improving

Patients who have a small-bore feeding tube in place and no liquid formulation is available, the patient will remain on the IV formulation.

The criteria for switching patients have been proven to result in successful PO therapy of these agents, however, clinical judgment must be exercised when evaluating each individual patient case. Below is a list of patient criteria to consider before making a switch.

When a patient meets the pre-defined criteria and in the pharmacist's clinical judgment is appropriate for IV to PO conversion, a note shall be entered in the patient's electronic medical record and an order entered by the pharmacist for the switch from IV to PO medication per committee-approved standard of care. The pharmacist will document the following in the progress notes:

- Other oral medications and/or nutrition the patient is tolerating
- Duration of IV therapy
- How patient meets criteria

If at any time the physician disagrees with the IV to PO switch, he/she may override this switch and note in the medication orders that the patient is to remain on the IV medication. If the physician disagrees, the patient will not be eligible for automatic conversion for this course of therapy.

Patient Characteristics to Consider for IV to PO Conversion:

A. General patient characteristics
    a. Psychological (patient refuses oral dose)
    b. Mechanical (esophageal incompetence)
    c. Severe nausea and vomiting
    d. Gastrointestinal obstruction or paralytic ileus
    e. Physiological (documented malabsorption syndrome)
    f. Inflammatory bowel disease; short bowel syndrome
    g. Any other condition requiring patient to be NPO (i.e. pancreatitis, active GI bleeding)
    h. Drug/nutrient interactions which may compromise absorption (i.e. rifampin, ketoconazole)
    i. Patient at risk for aspiration
    j. Patient receiving continuous nasogastric suctioning
    k. Hypochlohydric patients

l. GI Consults

B. Infection related characteristics
   a. Infectious disease consulted
   b. ICU patient
   c. Patient's infection is life-threatening
   d. Patient with serious infections that have a high rate of treatment failure
   e. (i.e. meningitis, sepsis, endocarditis, undrained abscesses, and *Staphyococcus aureus* or *Enterococcus* spp. bacteremia)
   f. Immunocompromised patients
   g. Patient with positive blood culture within 2 days
   h. Patient with positive CSF culture within 10 days
   i. Organism identified is multi-drug resistant
   j. Patient has been afebrile less than 24 hours

Quality review will be conducted per P&T recommendations to assess compliance of the pharmacy and the medical staff with the approved standard-of-care policy and procedure.

IV TO PO CONVERSION GUIDE:

Drug	Dose (IV:PO)	Bioavailability
Azithromycin	500 mg : 500 mg	37%*
Clindamycin	300 mg : 300 mg 600 mg : 600 mg	90%
Doxycycline	100 mg : 100 mg	80-95%
Fluconazole	200 mg : 200 mg 400 mg : 400 mg	>90%
Levofloxacin	250 mg : 250 mg 500 mg : 500 mg 750 mg : 750 mg	99%
Linezolid	600 mg : 600 mg	100%
Metronidazole	250 mg : 250 mg 500 mg : 500 mg	90%
Voriconazole	1 mg : 1 mg	95%
*Terminal half-life of azithromycin is 68 hours, may be switched to oral after two days of IV therapy per package insert recommendations.		

PROTOCOL 7

PROCEDURE:

The Department of Pharmacy will automatically convert selected medications from IV to PO/Enteral therapy per approved criteria. All adult patients on these IV medications are considered eligible and should be assessed.

ELIGIBILITY CRITERIA:

A patient will be considered a "candidate" for switch therapy if he/she meets ANY inclusion criteria and DOES NOT meet any exclusion criteria

A. Inclusion
    a. Patient has functioning GI tract and is expected to tolerate the oral dosage form AND must meet ANY of the following:
        i. Currently receiving a regular diet
        ii. Tolerating tube feeds for at least 24 hours (patient should not be converted from IV to Enteral within the first 24 hours of starting tube feeds)
        iii. Currently NPO or receiving a liquid diet AND taking > 1 significant oral/enteral medication:
            1. Antihypertensives, anticonvulsants, antiarrhythmics, antiglycemics, immunosuppressants, or any other medication that has a measurable outcome; immunosuppressants are excluded for kidney, kidney-pancreas, and liver transplant patients
B. Exclusion
    a. It is inappropriate to switch a patient to oral therapy if he/she has any of the following indications:
        i. Intractable nausea and vomiting
        ii. Documented malabsorption syndrome
        iii. For anti-infective therapy, patients with meningitis, endocarditis, *Staphylococcus aureus* osteomyelitis, or *Staphylococcus aureus* bacteremia
    b. It is inappropriate to switch a patient to oral therapy if infectious disease physician is consulted

IV TO PO CONVERSION GUIDE:

Drug	IV:PO Ratio	IV Dose	PO Dose	Additional Information
Ampicillin/sulbactam	–	1.5 g Q6H	500 mg/125 mg three times a day	Eligible for given FDA labeled indications: LRTI, otitis media, sinusitis, SSTI, UTI (No conversion for infections caused by Acinetobacter)
		3 g Q6H	875 mg/125 mg twice daily	
Azithromycin	1:1	500 mg	500 mg	–
Cefazolin	–	1-2 g Q8H	Cephalexin 500 mg four times a daily	Eligible for given FDA labeled indications: RTI, otitis media, SSTI, genitourinary tract infections (No conversion for bone infections)
Ceftriaxone	–	1-2 g Q12-24H	Cefdinir 300 mg twice daily	Eligible for given FDA labeled indications: CAP, sinusitis, uncomplicated SSTI, URTI, UTI
Ciprofloxacin	1:1.25	200 mg	250 mg	Separate dosing from multivalent cations by 2-4 hours; hold tube feeds 1 hour before & 2 hours after administration
Clindamycin	2:1	600 mg	300 mg	–
Doxycycline	1:1	100 mg	100 mg	Separate dosing from multivalent cations by 2-4 hours; administer with at least 8 oz of fluid; patient must be able to sit upright for at least 30 mins after taking
Fluconazole	1:1	100 mg	100 mg	–
Levofloxacin	1:1	500 mg	500 mg	Separate dosing from sucralfate or multivalent cations by 2-4 hours; hold tube feeds 1 hour before & 2 hours after administration
Linezolid	1:1	600 mg	600 mg	–
Metronidazole	1:1	500 mg	500 mg	–
Rifampin	1:1	600 mg	600 mg	–
Trimethoprim/ sulfamethoxazole	1:1	160 mg/800 mg	160 mg/800 mg	Dosing based on trimethoprim component
Voriconazole	–	4 mg/kg Q12H	Weight <40 kg: 100 mg Q12H	Eligible for conversion when patient is on maintenance dosing regimen
			Weight ≥40 kg: 200 mg Q12H	
Abbreviations: LRTI – lower respiratory tract infection, SSTI – skin and soft tissue infection, UTI – urinary tract infection, RTI – respiratory tract infection, CAP – community acquired pneumonia				

PROTOCOL 8

PURPOSE:

To establish guidelines for the conversion of intravenous to oral/enteral (IV to PO) medications.

BACKGROUND:

Many medications have near 100% oral bioavailability. The intravenous forms of these agents are useful in situations where the patient may have compromised gastrointestinal function. However, in cases where the patient is in need of continued therapy but is clinically stable with a functioning GI tract, oral therapy is a viable and preferred option. Many studies have documented the pharmacoeconomic benefit of an automatic, pharmacist- initiated automatic oral conversion program.

PROCEDURE:

A. All patients taking any of the intravenous medications listed in "IV to PO Conversion Guide" table below will be identified on a daily basis by the pharmacist, through a computer generated report. This report identifies patients that are receiving one of these medications AND are afebrile (temperature < 100.4 °C) for 24 hours, have an active diet order, and are receiving other oral medications. These patients also have NOT received anti-emetics or vasopressors within the prior 24 hours.
B. The pharmacist will then review the patient EMR and medication administration record for the criteria listed below in "Eligibility Criteria" section if applicable.
    a. If necessary, the reviewer will confer with the patient's nurse or physician to obtain necessary information.
    b. B. If the inclusion criteria for route change are met, without exclusion criteria being present, the pharmacist will transition the patient from IV to PO of the same medication and the orders will be placed in SCM as 'per protocol' orders.

ELIGIBILITY CRITERIA:

A. Inclusion
    a. Patient is receiving oral/enteral medications and/or oral/enteral diet already.
        i. If receiving enteral nutrition, patient is tolerating > 25 % goal tube feeds.
    b. The patient's clinical condition is improving and fever curve and/or WBC count are trending down on IV therapy.
    c. Patient adherence to oral therapy is anticipated.
    d. Afebrile X 24hrs
    e. Antimicrobial agent is being used to treat a single infectious disease
    f. The following indications warrant immediate switch to oral therapy if not initiated with oral:
        i. Lower urinary tract infections
        ii. Skin and soft-tissue infections
        iii. Specific prophylaxis in immune-compromised patients

B. Exclusion
    a. Antibiotics for the following indications requires a discussion with the prescriber prior to conversion:
        i. Meningitis
        ii. Endocarditis/endovascular infections
        iii. Sepsis (evidence of infection and two or more of the following criteria: temperature 38ºC (100.4ºF) or 36ºC (96.8ºF), heart rate 90 beats/min, respiratory rate 20 breaths/min or PaCO2 of 32 mmHg, and white-cell count of 12,000/mm3 or 4,000/mm3 or >10 percent immature neutrophils).
        iv. Bacteremia
        v. Septic arthritis / osteomyelitis
        vi. Non-draining abscess
        vii. Candidemia/Invasive Candidiasis
        viii. Invasive Aspergillosis / other invasive fungal infections
    b. Patient is strict NPO (ie. no oral OR enteral intake)
    c. Patient cannot adequately absorb oral medications
        i. Severe diarrhea
        ii. Uncontrolled vomiting
        iii. GI obstruction/motility disorder
        iv. Malabsorption syndrome
        v. Continuous gastric suctioning
        vi. Mucositis
        vii. Patient is in shock state (e.g. receiving high dose vasopressors) that would decrease enteric absorption

IV TO PO CONVERSION GUIDE:

Drug	IV:PO ratio	Tablet/Capsule Strength	Suspension Concentration	Crush?	Administration Directions
Azithromycin	1:1	250 mg	200 mg/5mL	Yes	-
Doxycycline	1:1	100 mg	25mg/5mL	No	• May open capsule. • Administer 2 hours before or 2 hours after multiple vitamins, antacids, or other products containing magnesium, aluminum, iron, or zinc. • Tube feeds must be held for 2 hours before and after oral administration. • Suspension: Administer on an empty stomach.
Fluconazole	1:1	200 mg	40 mg/mL	Yes	-
Levofloxacin	1:1	250 mg, 500 mg, 750 mg	25 mg/mL	Yes	• Administer 2 hours before or 2 hours after multiple vitamins, antacids, or other products containing magnesium, aluminum, iron, or zinc. • Tube feeds must be held for 2 hours before and after oral administration. • Suspension: Administer on an empty stomach.
Linezolid	1:1	400 mg, 600 mg	20 mg/mL	Yes	• If the patient can get a crushed tab instead of liquid, please use tab for cost concerns • Protect from light. • Suspension: invert gently to mix, do NOT shake.
Metronidazole	1:1	250 mg, 500 mg	50 mg/mL	Yes	-
Voriconazole	1:1	50 mg, 200 mg	200 mg/5mL	Yes	• Administer 1 hour before or after a meal. • Enteral tube feedings may decrease oral absorption; may hold tube feedings for 1 hour before and 1 hour after a voriconazole dose

PROTOCOL 9

PROCEDURE:

A. Evaluate patients who have received the intravenous form of the included medications for at least 48 hours.
B. Convert to an equivalent oral dose to complete the course of therapy as defined by the prescriber if the patient is not NPO (no food by mouth) and is tolerating oral medications.
C. Reassess patients who do not meet the above criteria daily unless there is clear evidence that a patient is not candidate for oral medications.
D. Evaluate formulary for potential items to be added to the IV to Oral Conversion guideline.

ELIGIBLE MEDICATIONS:

Azithromycin	Fluconazole	Linezolid
Doxycycline	Levofloxacin	Metronidazole

ELIGIBILITY CRITERIA:

A. Inclusion
    a. Tolerating oral fluids
    b. Patient is able to absorb medications orally, through NG or feeding tube
    c. Patient has received at least 48 hours of IV antimicrobials
    d. Patient is clinically stable: negative cultures ≥ 48 hours, WBC normalizing, afebrile ≥ 48 hours
B. Exclusion
    a. Pediatric patients: ≤ 18 years old
    b. NPO status: fistula, pancreatitis, IBD, abdominal surgery, malabsorption syndrome (N/V/D, short bowel syndrome, motility disorder, gastroparesis, etc), and active GI bleed
    c. At risk for aspiration
    d. Uninterrupted tube feeds
    e. Patient refusal
    f. Patient is hemodynamically unstable
    g. Critical care/ICU patients
    h. Serious or life-threatening infection or disease state
    i. Prescriber has indicated a specified duration of IV therapy longer than 2 days