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How to Promote Residency Growth and Advance Clinical Pharmacy Practice

Jim Coons, PharmD, FACC, FCCP, BCCP

Professor, University of Pittsburgh School of Pharmacy

Clinical Pharmacist, Cardiology, UPMC Presbyterian Hospital

Pittsburgh, PA

Learning Objectives

1. Discuss the benefits of residency expansion to advance clinical pharmacy practice

2. Describe opportunities for residency growth and expansion of clinical services with residents

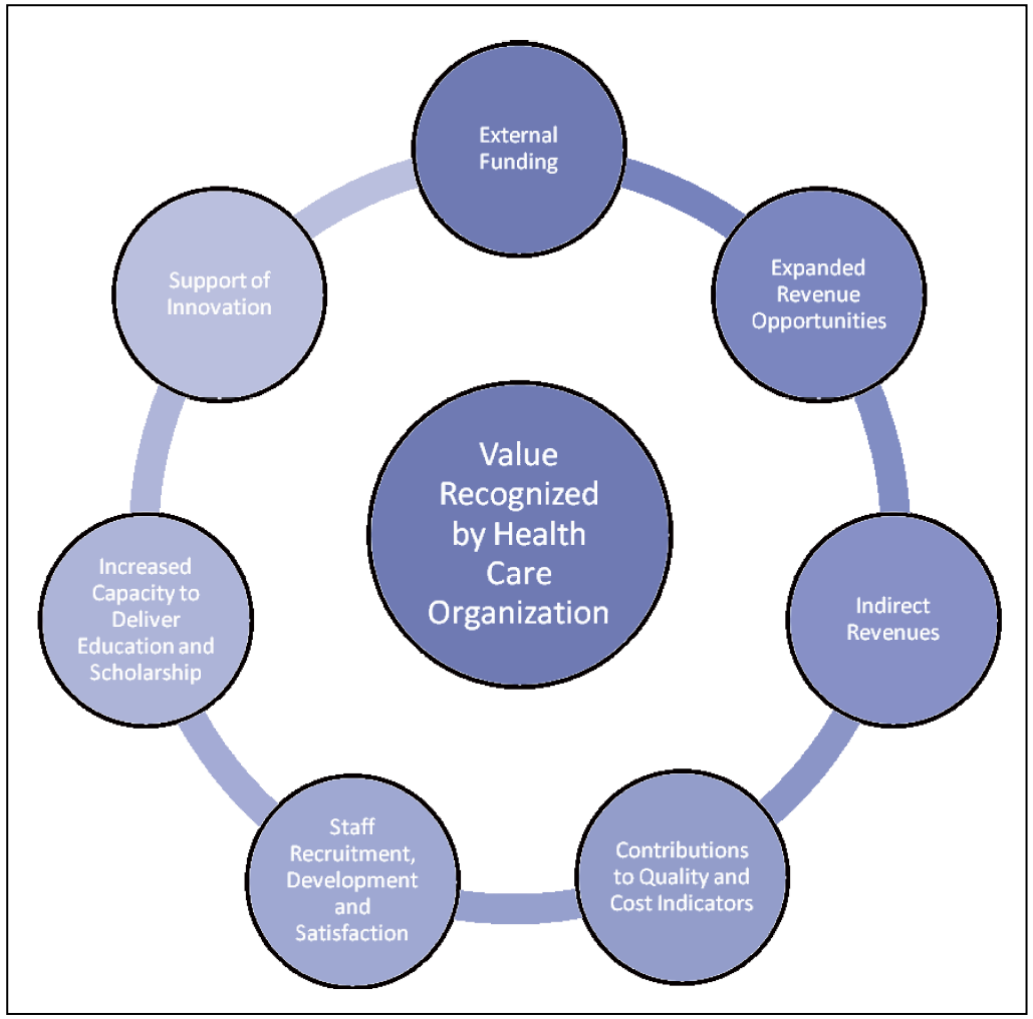
3. Highlight an example of how to successfully enhance a residency program and a clinical pharmacy service

Relevant Disclosures

No financial relationships relevant to this activity.

Benefits of Residency Growth to Advance Clinical Practice

Value from Residency Training: The Organizational Perspective



Pharmacotherapy 2010;30:490e-510e.

Clinical Service Contributions

- Patient care rounds
- Target drug monitoring
- Patient monitoring
- Extend clinical pharmacy services
- Provide education
- Conduct practice-based research
- Facilitate leadership/ management activities
- Engage in community service
- Direct participation in medication use system (staffing)

Pharmacotherapy 2010;30:490e-510e.

Other Benefits

- "Feeder system" – talent pool
- Surrogate marker of excellence
- Sign of a quality work environment
- Promotes personal and professional development of pharmacy staff
- Expand preceptor base
- Job satisfaction/retention
- Student-resident integration ("layered learning")
- Support of innovation
- Establishment of new services
- "Multiplier effect"

Pharmacotherapy 2010;30:490e-510e.

Perceptions of Resident Value: Academic Medical Center Perspective

- Support of innovation
- Contributions to quality and cost indicators
- Increased capacity to deliver education & scholarship
- Expanded revenue opportunities
- Indirect revenues

Am J Health-Syst Pharm 2012;69:158-65.

Cost Benefits of Residents as Pharmacy Extenders

- Benefit:cost ratio of 1.3:1 up to 2.3:1
- Resident productivity estimated to save the institution $563,936 (Pasek et al. 2010)
- Pass-through funding from CMS offsets significant portion of costs for PGY1 residents

Can J Hosp Pharm 1993;46:147-53. Am J Hosp Pharm 1982;39:1517-20. Am J Health-Syst Pharm 2010;67:1952-7. Am J Health-Syst Pharm 1998;55:1620-3.

Selected Evidence for Enhanced Clinical Services or Outcomes with Residents

Primary Author/Year	Design	Clinical Service Impact	Main Findings	Citation
Smith 2003	Descriptive	Expansion of **on-call services** to evening (PK, drug info, antimicrobial recs, ADE mgmt, code response, med histories for HIV pts, staffing)	Mean of 7.4 on-call activities per day; ↑ resident competence through unique learning experience	Am J Health-Syst Pharm 2003;60:2236-41.
Terceros 2007	Matched-pair with historical control	PGY1 rounding on **internal medicine** team over 4-weeks	250 recommendations (92% accepted); ↓ LOS by 3 days (p=0.008); ↓ total cost of care to health system by $163,560	Ann Pharmacother 2007;41:742-48.
Toma 2007	Cross-sectional survey	Resident participation in **code response**	30% of program required resident participation; 38% optional	Am J Health-Syst Pharm 2007;64:747-53.
Rabi 2007	Descriptive	**Med rec** on cardiology floor by primary care resident	56 interventions over 10-days	Pharm Educ 2007;7:351-57.
Daghstani 2012	Prospective, observational	**Financial impact** of interventions by PGY1's over 4-months	Annualized net economic benefit of 1 resident: $167,464	Hosp Pharm 2012;47:214-18.
Phillips 2012	Descriptive	**Community-based outpatient clinic** and role of PGY2 amb care resident	Patients meeting lipid & HTN goals ↑ 50%; ↓ HbA1c levels	Am J Health-Syst Pharm 2012;69:880-84.
McConeghy 2012	Descriptive	**24-hour inhouse on-call program staffed by residents**	Services highlighted: code response, ischemic stroke & STEMI (lytics), Crotalidae antivenin, factor VIIa, sepsis mgmt	Am J Health-Syst Pharm 2012;69:2160-4.

Selected Evidence for Enhanced Clinical Services or Outcomes with Residents

Primary Author, Year	Design	Clinical Service Impact	Summary of Main Findings	Citation
Wilhelm 2011	Retrospective review (pre/post)	**Anticoagulation** teaching service	↑ patient education & ↓ 60-day readmission rate	Am J Health-Syst Pharm 2011;68:2086-93.
Salas, 2015	Prospective, single-center pilot	Transition of care for **heart failure (HF)** by PGY1 resident	↓ readmissions (28.1% to 16.6%)	Am J Health-Syst Pharm 2015;72(suppl 1):S43-7.
Truong 2015	Retrospective with historical control	Continuum of care resident for HF	↓ readmissions (24% to 12%) ↑ HF core measure compliance rate	SAGE Open Med 2015;3: 2050312115577986.
Host, 2014 Hill JD, 2017	Descriptive Descriptive	Expansion of second-shift **decentralized clinical services** by PGY1's Expansion of decentralized clinical services by PGY1's	↑ from 3-5 residents, added 2nd-shift coverage Residents provided comparable level of services vs. staff (workload metrics)	Am J Health-Syst Pharm 2017;74:1085-92.
Gardner, 2016	Retrospective review	**Cost avoidance and quality of interventions** by PGY2 psychiatric residents	↑ clinical interventions and documented cost avoidance in aggregate and by resident	Am J Health-Syst Pharm 2016;73:e46-53.
Siegfried, 2017	Pre/Post	Integration into **antimicrobial stewardship program** (ASP) – weekend coverage (PGY2 ID & CC)	↓ aggregate antimicrobial use ↓ incidence *C. diff.*	Am J Health-Syst Pharm 2017;74:417-23.

Call for Future Research

- Need for control group to better evaluate causal relationship
- Randomized, prospective crossover design
- Quasi-experimental methods – association between residency training and outcomes with appropriate statistical analysis/control for co-variates
- Need for clinically meaningful (or surrogate) outcomes
  - Those valued by the institution
    - Quality indicators
    - Affecting reimbursement (core measures, patient satisfaction, readmissions)

J Pharm Practice 2014;27:399-411.

Opportunities for Residency Growth and to Expand Clinical Services

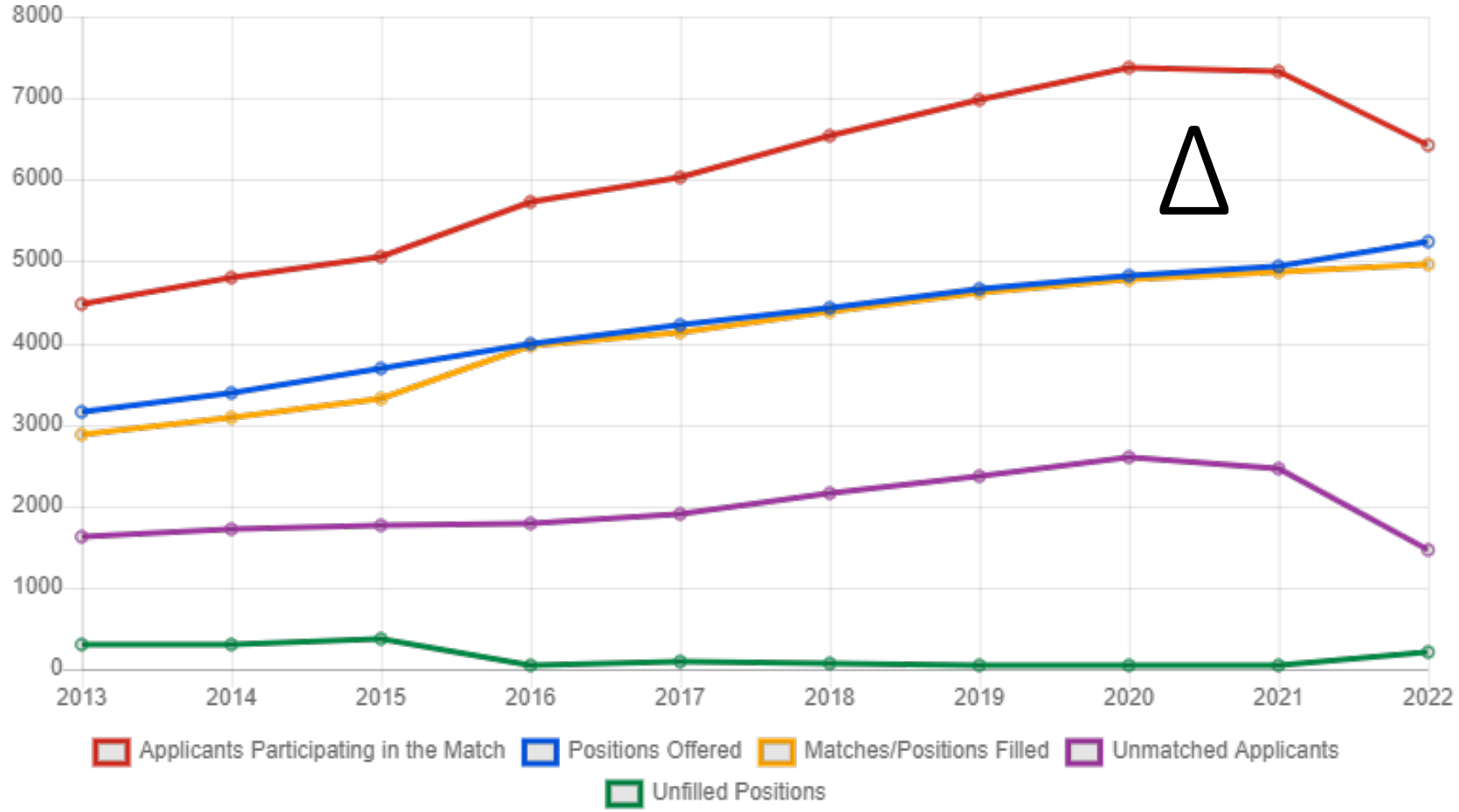
Residency as the "Gold Standard" for Direct Patient Care Practice

- ASHP 2015 Initiative – 90% of pharmacists entering health-system practice by the year 2015 would have residency training
  - PPMI
  - Practice Advancement Initiative

- ACCP – all pharmacists involved in direct patient care to complete residency by 2020

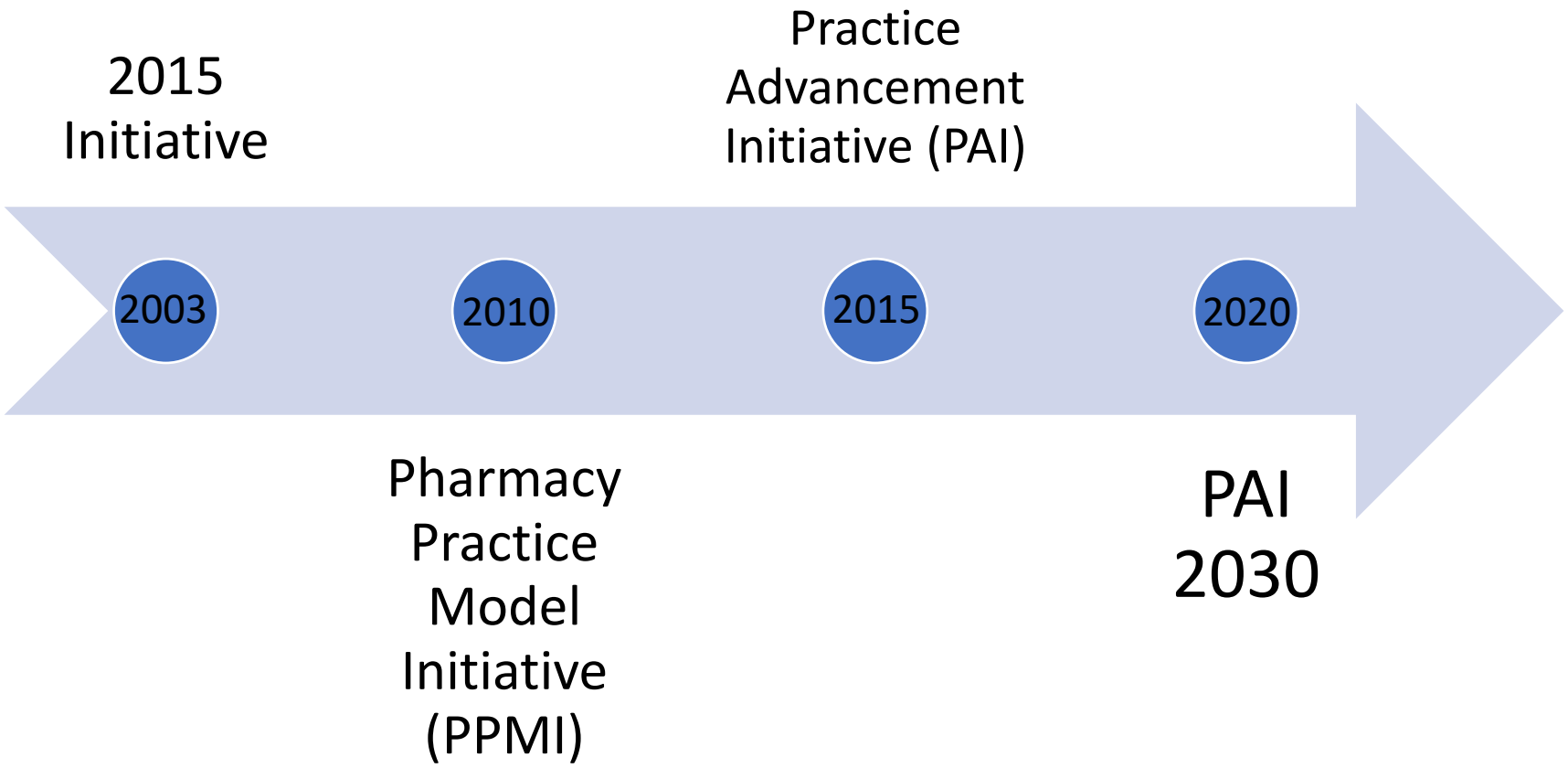
www.ashp.org/2015
Pharmacotherapy 2006;26:722-33.

ASHP Match Statistics: 2022



https://natmatch.com/ashprmp/stats.html

ASHP: Vision for Advancing Pharmacy Practice



Am J Health-Syst Pharm 2020;77:113-22.

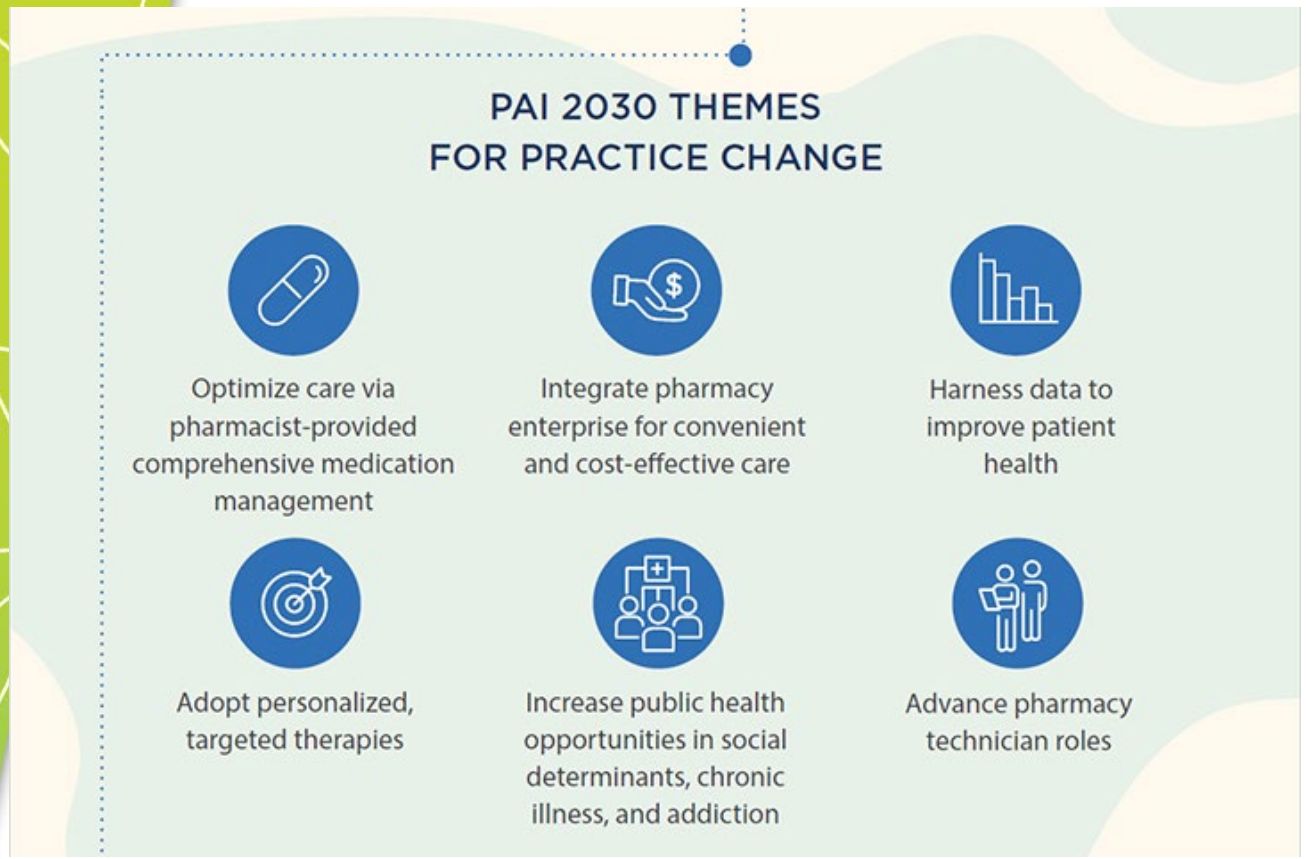
ASHP PAI 2030

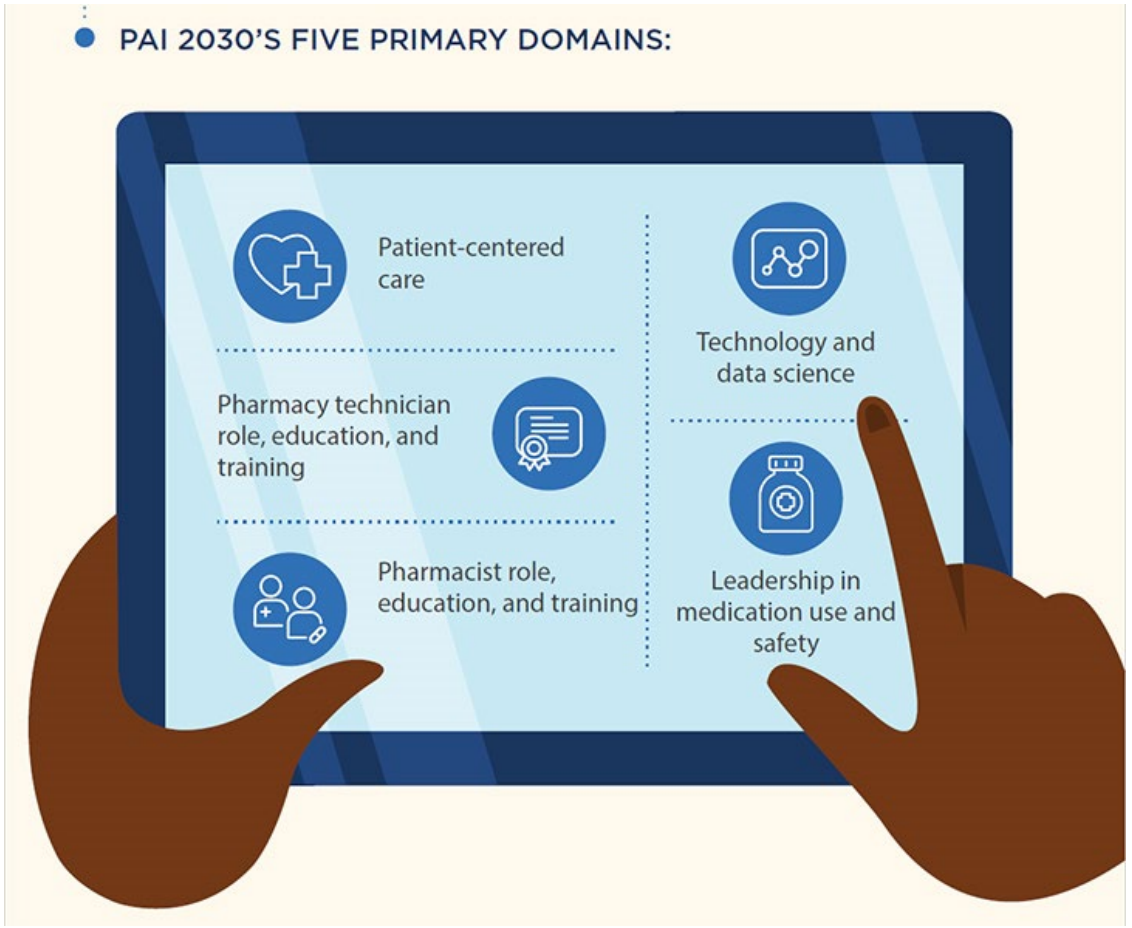
- Goal: to significantly advance the health and well-being of people by supporting patient-centered care delivery models that optimize the most effective use of pharmacists as direct patient care providers

- 59 recommendations to promote optimal, safe, and effective medication use, expand pharmacist and technician roles, and implement latest technologies

Am J Health-Syst Pharm 2020;77:113-22.
ASHP.ORG/PAI

ASHP PAI 2030





Am J Health-Syst Pharm 2020;77:113-22.
ASHP.ORG/PAI

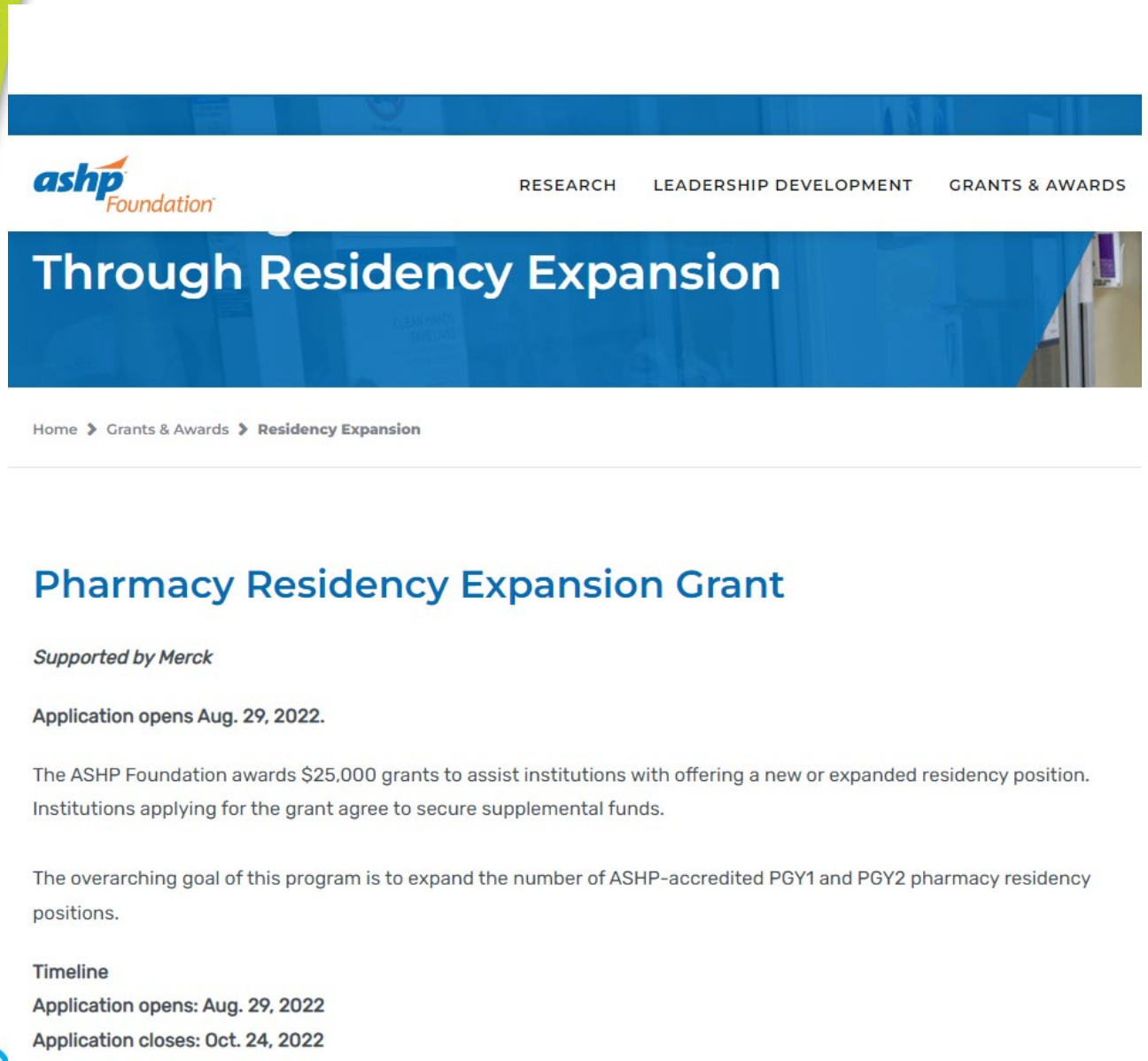
Resident-Specific Opportunities and Needs

- Within PAI 2030:
  - B. Pharmacist role, education, and training
    - *Organization-focused*:
      - B4. Health systems should require completion of ASHP-accredited residency training as a minimum credential for new pharmacist practitioners

- Need to document minimum qualifications (PGY2 training) for those pharmacists who engage in direct patient care for specialized populations involving complex medication-use issues
  - Help effort to reinstate CMS funding (*funding retracted in 2003*)

Am J Health-Syst Pharm 2020;77:113-22.
ASHP.ORG/PAI

Opportunities for Funding



ashp Foundation

RESEARCH LEADERSHIP DEVELOPMENT GRANTS & AWARDS

Through Residency Expansion

Home > Grants & Awards > Residency Expansion

Pharmacy Residency Expansion Grant

Supported by Merck

Application opens Aug. 29, 2022.

The ASHP Foundation awards $25,000 grants to assist institutions with offering a new or expanded residency position. Institutions applying for the grant agree to secure supplemental funds.

The overarching goal of this program is to expand the number of ASHP-accredited PGY1 and PGY2 pharmacy residency positions.

Timeline

Application opens: Aug. 29, 2022

Application closes: Oct. 24, 2022

- 3 grants of $25,000 to establish new positions
- > $3.5M funding since 2011 to create > 100 PGY1 and PGY2 resident positions

https://www.ashpfoundation.org/grants-and-awards/pharmacy-residency-expansion-grant

How to Enhance a Residency Program: Examples

My Residency Training Story as a Preceptor/Mentor/RPD

- Preceptor since 2003
- Approximately 100 residents trained
- PGY1 RPD (2005-2012) – Allegheny General Hospital (AGH; Pittsburgh, PA)
- PGY2 Cardiology RPD (2012-Present) – UPMC Presbyterian (Pittsburgh, PA)

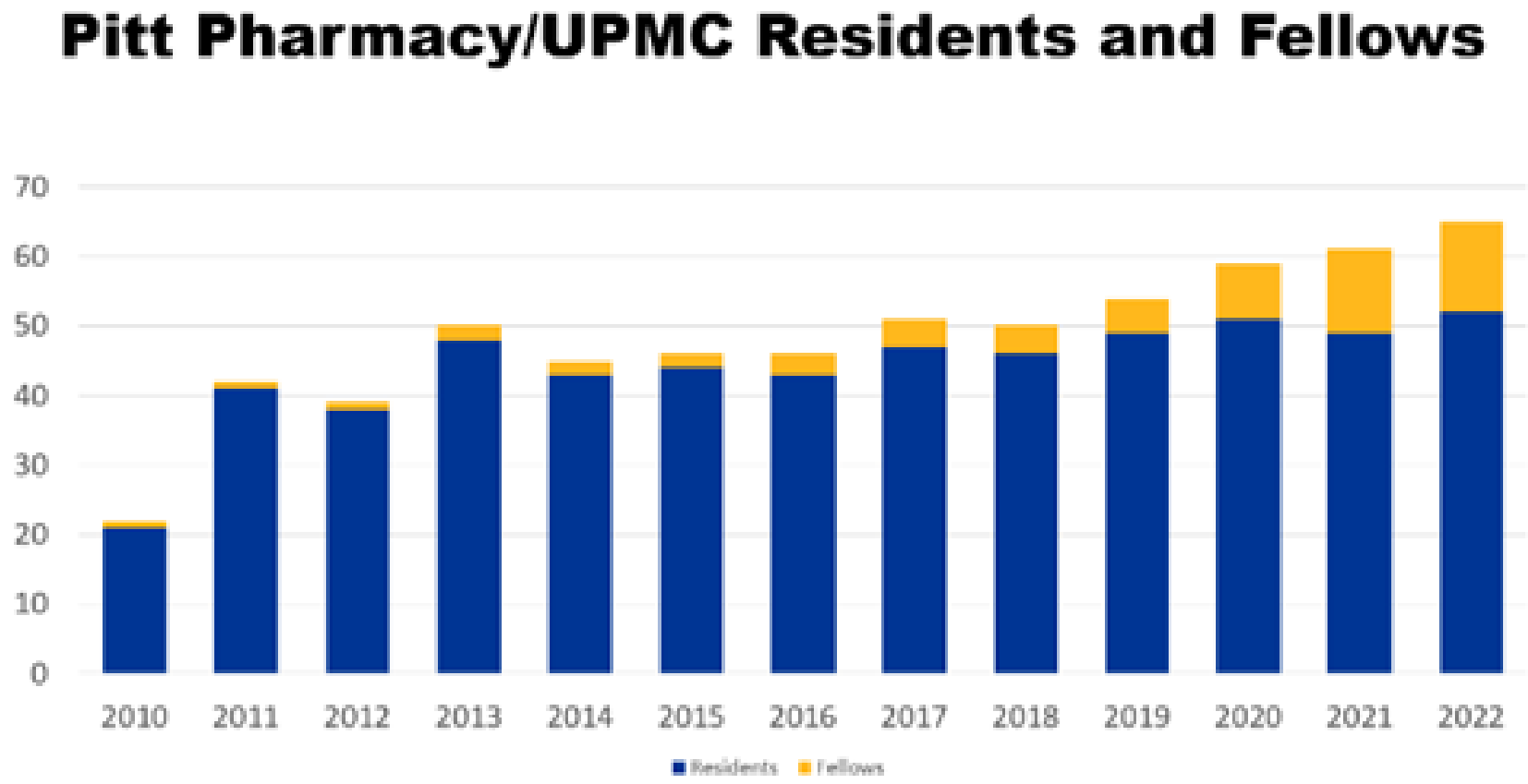
AGH – Example

- Expansion of program
- Goal – increase size and scope of program & clinical services
- Led successful application for residency expansion grant
- Provided foundation for immediate and sustainable growth of program
- Further showcased value of pharmacy residency training to hospital administration

UPMC - Example

- My philosophy – deploy tradition of having resident involved in all aspects of direct patient care as an extension of my practice
- Goal – design and implement new resident learning experiences
- Historically, strengths in cardiovascular critical care and academia
- Created many new and innovative services and resident learning experiences

UPMC Pharmacy Residency Programs



UPMC PGY2 Cardiology Residency Program

UPMC
LIFE CHANGING MEDICINE

PGY2 CARDIOLOGY
PHARMACY RESIDENCY
UPMC PRESBYTERIAN SHADYSIDE

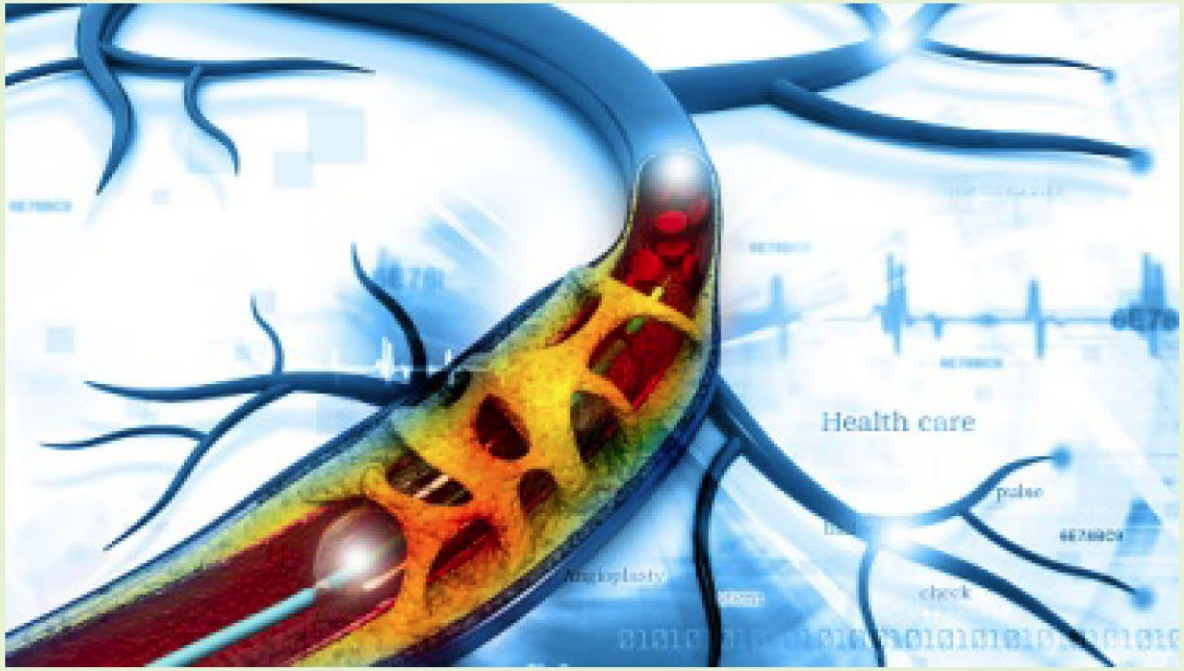
Expansion of New Learning Experiences for Residents

- Advanced Heart Failure
- Pulmonary Hypertension
- General Cardiology
- Outpatient Cardiology
- Electrophysiology
- Post-Cardiac Arrest

Clinical Pharmacogenomics (PGx)

- Required longitudinal learning experience
- Implements *CYP2C19* genotype-guided antiplatelet therapy after percutaneous coronary intervention
- Pharmacist-driven service
- Resident reviews, interprets results in context of clinical factors to make recommendations for appropriate P2Y12 inhibitor use in patients who underwent percutaneous coronary intervention (PCI)
- Communication with providers and documentation

PreCISE-Rx – PGx Implementation at UPMC



UPMC Uses Gene Test to 'Personalize' Meds for Heart Patients

Test checks for gene variant that limits response to blood thinner used after blood vessel stenting.
Read More>>

University of Pittsburgh School of Pharmacy
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ashp pharmacists advancing healthcare
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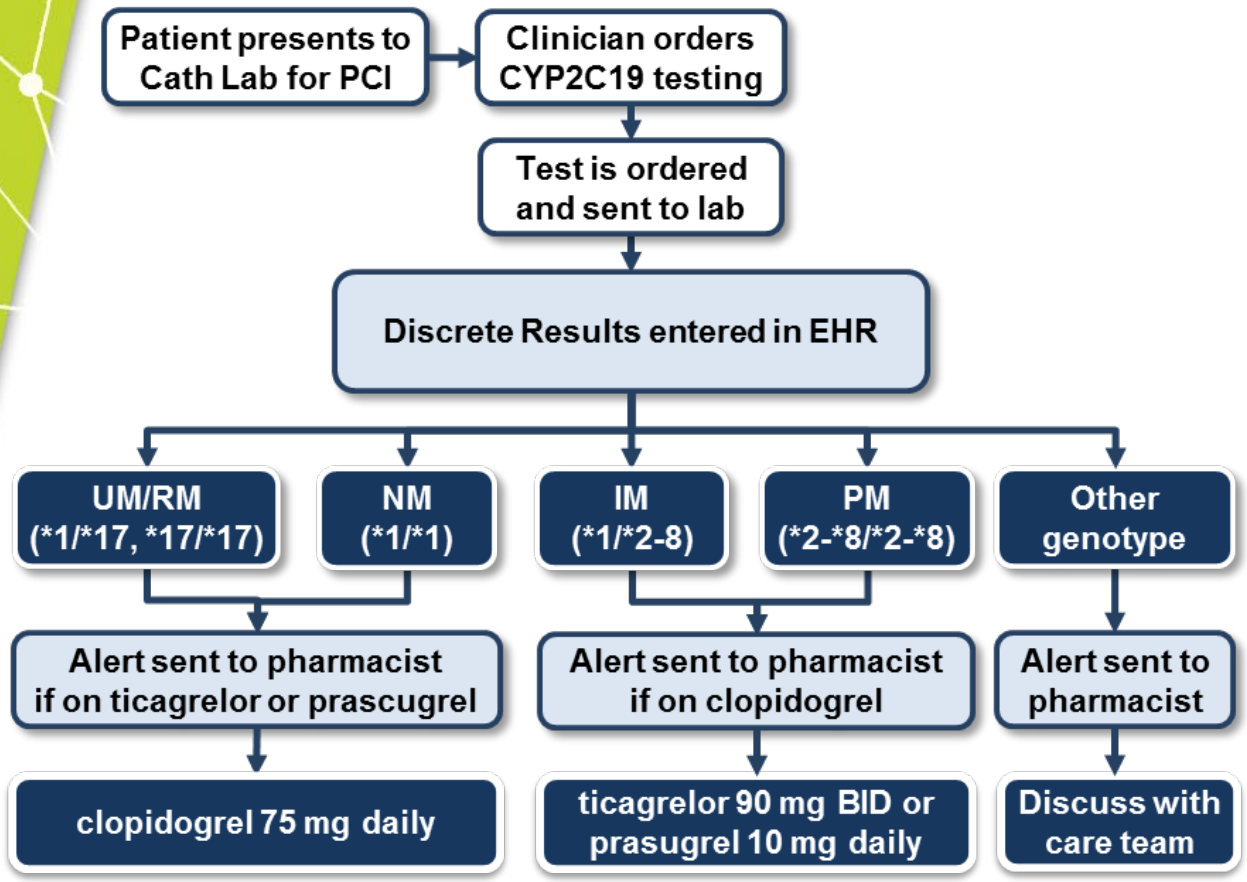
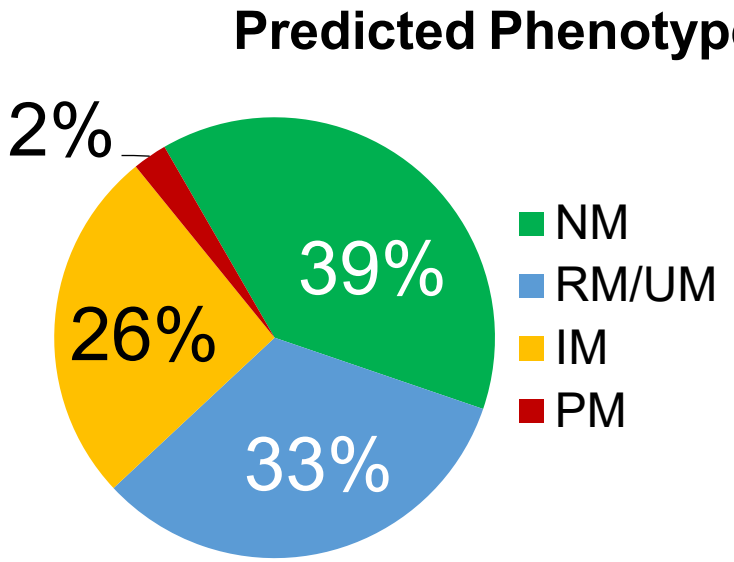
Clinical PGx Service Workflow



- √ *Clinical "standard-of-care"*
- √ On-site testing
- √ Protocolized ordering; therapy modification
- √ Pharmacist-led clinical services
- √ Discrete results in both Epic & Center
- √ Interruptive clinical decision support

Clinical PGx Metrics

- > 250 resident-patient encounters since 2019



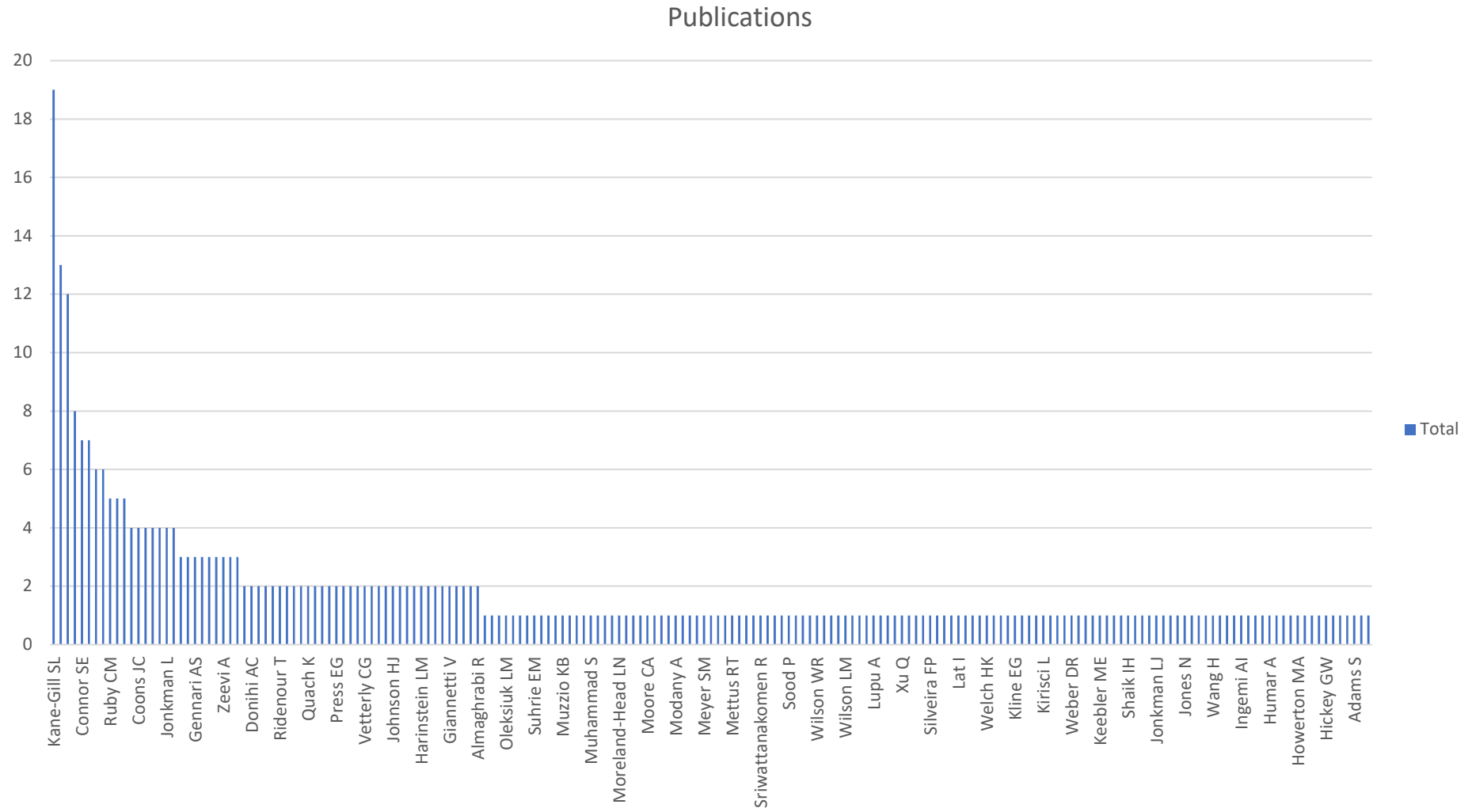
- Cumulative PreCISE-Rx genotyping (n = 3,777 as of 12/31/21)
- 28.6% (n=1081/3777) carry loss-of-function variants
- 18.9% (n=714/3777) with actionable genotypes

JACC Cardiovasc Interv 2018;11:181-91.
J Am Heart Assoc 2022;11:e024159.

Other Ways To Enrich the Residency Experience

- Scholarship and Research
  - Write as an extension of practice
  - Published contributions with resident co-authors on original research, review articles, case series, book chapters
- Teaching, Precepting, and Mentorship
  - PharmD cardiovascular therapeutics module lecturer and facilitator
  - Simulation-based education
  - Primary preceptor for APPE rotation
  - Student mentoring

Resident Involvement in Scholarship and Research



Examples of Resident-Driven Research

A Systemwide Approach for Navigating the Dilemma of Oral Factor Xa Inhibitor Interference With Unfractionated Heparin Anti–Factor Xa Concentrations

Annals of Pharmacotherapy
2021, Vol. 55(5) 618–623
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Marissa N. Levito, PharmD[1], James C. Coons, PharmD, BCCP[1,2], Margaret M. Verrico, RPh[1], Adrienne Szymkowiak, PharmD[1], Brianna Legler, PharmD[1,3], Eric J. Dueweke, MD[1], and Sandra L. Kane-Gill, PharmD, MSc[1,2]

Abstract

Background: Oral factor Xa inhibitors are known to significantly increase heparin anti-Xa concentrations, which leads to inaccuracies when monitoring intravenous unfractionated heparin (IV UFH). Guidance for managing this laboratory interference is lacking, creating substantial uncertainty in clinical practice. **Objective:** To describe a strategy used by a large academic institution for managing the controversy of laboratory interference in the setting of oral factor Xa inhibitor use and provide effectiveness and safety data for this approach. **Methods:** In December 2016, a new Heparin IV Direct Oral Anticoagulant (DOAC) Interference PowerPlan (a comprehensive order set) was made available in the electronic health record (Cerner, North Kansas City, MO) throughout the health system. We retrospectively examined 169 patients with events reported in the error reporting system, RISKMASTER, and evaluated reports with and without the use of the PowerPlan. Effectiveness was determined through evaluation of thrombosis. The Naranjo criteria for causality were applied to assess thrombotic events. **Results:** Of 56 events that were reported with apixaban when the PowerPlan was not ordered, 4 (7%) thrombotic events occurred within 7 days of UFH initiation. One out of the 4 events (25%) that occurred when the PowerPlan was not appropriately initiated was considered probable using the Naranjo Scale. Three additional events (75%) were possible using the Naranjo Scale. **Conclusion and Relevance:** The Heparin IV DOAC Interference PowerPlan appears to be conducive to positive patient outcomes when evaluating voluntary reported events and may assist clinicians with managing the therapeutic dilemma of this laboratory interference.

Keywords

anticoagulation, heparin, medication safety, anticoagulants, cardiology

Use of Disproportionality Analysis to Identify Previously Unknown Drug-Associated Causes of Cardiac Arrhythmias Using the Food and Drug Administration Adverse Event Reporting System (FAERS) Database

Journal of Cardiovascular Pharmacology and Therapeutics
2021, Vol. 26(4) 341-348
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DOI: 10.1177/1074248420984082
journals.sagepub.com/home/cpt
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Lindsay N. Moreland-Head, PharmD[1], James C. Coons, PharmD, BCCP[1,2], Amy L. Seybert, PharmD, CHSE[1,2], Matthew P. Gray, PharmD[2], and Sandra L. Kane-Gill, PharmD, MS[1,2]

Abstract

Introduction: Drug-induced QT_c-prolongation is a well-known adverse drug reaction (ADR), however there is limited knowledge of other drug-induced arrhythmias. **Purpose:** The objective of this study is to determine the drugs reported to be associated with arrhythmias other than QT_c-prolongation using the FAERS database, possibly identifying potential drug causes that have not been reported previously. **Methods:** FAERS reports from 2004 quarter 1 through 2019 quarter 1 were combined to create a dataset of approximately 11.6 million reports. Search terms for arrhythmias of interest were selected from the Standardized MedDRA Queries (SMQ) Version 12.0. Frequency of the cardiac arrhythmias were determined for atrial fibrillation, atrioventricular block, bradyarrhythmia, bundle branch block, supraventricular tachycardia, and ventricular fibrillation and linked to the reported causal medications. Reports were further categorized by prior evidence associations using package inserts and established drug databases. A reporting odds ratio (ROR) and confidence interval (CI) were calculated for the ADRs for each drug and each of the 6 cardiac arrhythmias. **Results:** Of the 11.6 million reports in the FAERS database, 68,989 were specific to cardiac arrhythmias of interest. There were 61 identified medication-reported arrhythmia pairs for the 6 arrhythmia groups with 33 found to have an unknown reported association. Rosiglitazone was the most frequently medication reported across all arrhythmias [ROR 6.02 (CI: 5.82-6.22)]. Other medications with significant findings included: rofecoxib, digoxin, alendronate, lenalidomide, dronedarone, zoledronic acid, adalimumab, dabigatran, and interferon beta-1b. **Conclusion:** Upon retrospective analysis of the FAERS database, the majority of drug-associated arrhythmias reported were unknown suggesting new potential drug causes. Cardiac arrhythmias other than QTc prolongation are a new area of focus for pharmacovigilance and medication safety. Consideration of future studies should be given to using the FAERS database as a timely pharmacovigilance tool to identify unknown adverse events of medications.

Keywords

adverse drug reaction reporting systems, drug-related side effects and adverse drug reactions, pharmacovigilance, cardiac arrhythmia

Examples of Resident-Driven Research

J Thromb Thrombolysis (2016) 42:6–10
DOI 10.1007/s11239-015-1321-4

Clinical effectiveness and safety outcomes associated with prothrombin complex concentrates

Ashley Hedges[1] · James C. Coons[2] · Melissa Saul[3] · Roy E. Smith[4]

Published online: 19 December 2015

Abstract Prothrombin complex concentrates (PCCs) are indicated for urgent reversal of warfarin and used for reversal of novel oral anticoagulants, in patients with acute major bleeding or need for an urgent procedure. The research goal was to evaluate effectiveness and safety outcomes with PCC usage at our institution. A retrospective review of electronic medical records identified patients that received a PCC commercially available in the United States (KCentra® or Profilnine®) at twelve hospitals in a tertiary care health system from July 1, 2013 to April 30, 2014. A total of 193 patients received PCC, of which 184 Hgb >7 g/dL was 8.48 h (IQR 6.95–13.00). Eight patients (4.1 %) developed an acute venous thromboembolism following PCC administration. INR reversal was achieved in approximately two-thirds of patients, with a low incidence of venous thromboembolism. Four-factor PCC is a viable alternative to plasma.

Keywords Prothrombin complex concentrates · Hemorrhage · Hemostasis · Warfarin

Journal of Cardiovascular Pharmacology and Therapeutics
2017, Vol. 22(6) 546-551

DOI: 10.1177/1074248417698042
journals.sagepub.com/home/cpt
SAGE

Triple Antithrombotic Therapy With Aspirin, P2Y12 Inhibitor, and Warfarin After Percutaneous Coronary Intervention: An Evaluation of Prasugrel or Ticagrelor Versus Clopidogrel

Nathan J. Verlinden, PharmD[1], James C. Coons, PharmD, BCPS (AQ-Cardiology)[2,3], Carlo J. Iasella, PharmD[3], and Sandra L. Kane-Gill, PharmD, MS, FCCM, FCCP[3,4]

Abstract

Background: Triple antithrombotic therapy is used in patients who require systemic anticoagulation and undergo percutaneous coronary intervention (PCI) requiring dual antiplatelet therapy. Bleeding with this combination is significant; however, few studies have described outcomes with the use of newer oral $P2Y_{12}$ inhibitors in this setting. **Objectives:** We aimed to compare outcomes among patients prescribed triple therapy with prasugrel or ticagrelor compared to triple therapy with clopidogrel in patients who underwent PCI and required warfarin. **Methods:** We retrospectively evaluated 168 patients who received either prasugrel (n = 32) or ticagrelor (n = 10) and were matched (1:3) to those who received clopidogrel (n = 126) at the time of discharge from the index PCI visit. Matching was performed based on age ± 10 years, sex, and indication for PCI. The primary outcome was the incidence of any bleeding during the 12-month follow-up. We also evaluated major adverse cardiovascular and cerebrovascular events (MACCEs). **Results:** Patient baseline characteristics were similar between groups. There was a significant excess of bleeding in patients who received prasugrel or ticagrelor compared to clopidogrel as part of triple therapy (28.6% vs 12.7%; odds ratio, 3.3; 95% confidence interval, 1.38-8.34). No differences were seen between groups in MACCEs. **Conclusions:** The use of prasugrel or ticagrelor as part of triple antithrombotic therapy among patients who underwent PCI and received warfarin was associated with significantly more bleeding compared to patients who received clopidogrel. Therefore, higher potency $P2Y_{12}$ inhibitors should be used cautiously in these patients.

Keywords
triple therapy, antiplatelet, anticoagulant, bleeding, percutaneous coronary intervention

Examples of Review Articles and Case Reports

Ticagrelor Use in a Patient With a Documented Clopidogrel Hypersensitivity

Annals of Pharmacotherapy
2014, Vol. 48(9) 1230–1233

DOI: 10.1177/1060028014539143
aop.sagepub.com
SAGE

Justin R. Harris, PharmD[1], and James C. Coons, PharmD[1]

Abstract

Objective: To report the use of ticagrelor in a patient with a documented hypersensitivity reaction to clopidogrel. **Case Summary:** A 64-year-old woman presented with non-ST-segment elevation myocardial infarction (NSTEMI) with a history significant for a hypersensitivity reaction to clopidogrel and was medically managed. Based on the patient's past medical history and current evidence available, the determination was made to use ticagrelor in this patient. Ticagrelor was administered without reaction during the hospital stay and on assessment at 2 and 4 weeks postdischarge. **Discussion:** Hypersensitivity occurs in approximately 1% of patients receiving clopidogrel. Although the risk of hypersensitivity reaction to clopidogrel is low, evidence to support alternative antiplatelets in this setting is relatively limited. Prasugrel has a similar structure to clopidogrel and, therefore, may cross-react. Furthermore, prasugrel is not recommended in the medical management of NSTEMI. Ticagrelor is a newer P2Y12 inhibitor that contains a cyclopentyltriazolopyrimidine structure. Because of the difference in structure, a lower theoretical risk of cross-reactivity with the thienopyridines would be anticipated. However, there are no reports to date that investigate the use of this agent in patients with a documented thienopyridine allergy. **Conclusions:** The current case report describes the use of ticagrelor in a patient with documented hypersensitivity to clopidogrel. In this patient, ticagrelor was well tolerated during hospital admission and at 2 and 4 weeks postdischarge following administration.

Keywords
ticagrelor, clopidogrel, hypersensitivity, acute coronary syndrome (ACS)

Strategies to Reduce Bleeding Risk in Acute Coronary Syndromes and Percutaneous Coronary Intervention: New and Emerging Pharmacotherapeutic Considerations

James C. Coons,[1,*] and Taylor Miller[2]
[1]University of Pittsburgh School of Pharmacy, Pittsburgh, Pennsylvania; [2]Department of Pharmacy, UPMC-Presbyterian Hospital, Pittsburgh, Pennsylvania

Bleeding is a well-recognized complication among patients who undergo percutaneous coronary intervention for acute coronary syndromes. Patients who bleed in this setting have higher morbidity, mortality, and resource use. Several bleeding avoidance strategies have been identified including the use of certain pharmacologic interventions; however, the antithrombotic landscape for this patient population is evolving rapidly. Numerous practical issues are related to the appropriate selection and dosing of antiplatelets and anticoagulants, as well as their combinations, that may have an impact on bleeding. Thus we reviewed the recent evidence that describes the use of these agents and provide recommendations on the appropriate use of antiplatelets and anticoagulants in the context of current practice and guideline recommendations. Opportunities exist to reduce bleeding complications through the adoption of bleeding avoidance strategies and appropriate use of antiplatelets and anticoagulants. Pharmacist expertise is critical in the appropriate selection, dosing, and monitoring of these medications to improve patient safety as it relates to bleeding potential. Clinical outcomes evaluating combinations of antiplatelets and anticoagulants, particularly with novel anticoagulants, are ongoing as are studies that incorporate use of genotype and phenotype into antithrombotic decision making.
KEY WORDS acute coronary syndrome, anticoagulation, antiplatelets, adverse drug reactions, bleeding.
(Pharmacotherapy 2014;34(9):973–990) doi: 10.1002/phar.1447

Examples of Review Articles and Case Reports

Safe and effective use of prostacyclins to treat pulmonary arterial hypertension

James C. Coons, Megan Clarke, Matthew R. Wanek, Abby Bauer, and Heather R. Bream-Rouwenhorst

Am J Health-Syst Pharm. 2013; 70:1716-23

Pulmonary arterial hypertension (PAH) is a progressive, incurable disease of the small pulmonary arteries that results in right ventricular failure and, ultimately, death if the patient does not receive a lung transplant.[1] Significant advances in the management of PAH over the past two decades have been made as a result of the increased availability of novel medications and delivery systems to treat this disease. There are currently nine Food and Drug Administration (FDA)-approved therapies for the management of PAH including phosphodiesterase type-5 inhibitors, endothelin-receptor antagonists, and prostacyclin agonists. The parenteral prostacyclins, including epoprostenol and treprostinil, are recommended as first-line therapies for patients at higher risk of death based on clinical assessment.[1] Even patients who initially present as lower risk and are treated with oral or inhaled therapies often require parenteral prostacyclins as their disease progresses.[1] Because of the acuity of this patient population, complexity of the medical regimens used, and significant medication costs (generally in excess of $100,000 annually for prostacyclin therapy), pharmacists should serve an integral role in ensuring successful outcomes for these patients.

Results of a national survey by the Prostacyclin Safety Group found that errors during infusion of parenteral prostacyclins are frequent and that many are associated with serious or fatal consequences.[2] Commonly cited reasons for errors included a lack of standardization in policies and guidelines, inconsistent use of hospital versus home i.v. infusion pumps, errors in dosage calculations, and inconsistent use and storage of backup medication cassettes.[2] Clearly, these problems are interprofessional in their scope and in their resolution. This article describes the pharmacist's role in helping to ensure the safe and appropriate use of prostacyclin-based therapies for patients with PAH. Specific examples of strategies to improve the safe use of these medications are also provided.

Inhaled prostacyclins. Prostacyclins are the mainstay of therapy for higher-risk patients with PAH, and inhaled prostacyclins may offer practical advantages over parenteral therapies, which carry the risk of infections and challenges associated with proper preparation and maintenance of the infusion.[1] Inhaled prostacyclins exert their effects locally by causing direct vasodilatory, antiproliferative, and antiplatelet actions on the pulmonary artery vasculature.[1] Iloprost is an analog of epoprostenol, which was approved in 2004 to improve

Treatment of Heparin-Induced Thrombocytopenia: Is There a Role for Bivalirudin?

Amy L. Seybert, Pharm.D., James C. Coons, Pharm.D., and Kristin Zerumsky, Pharm.D.

The recognition and management of heparin-induced thrombocytopenia (HIT) and heparin-induced thrombocytopenia with thrombosis syndrome (HITTS) has been evolving over the past several years. Although HIT is a relatively uncommon adverse event in patients receiving heparin therapy, it bears a significant risk of thrombotic events. If patients are left untreated, 50% can develop thrombosis. Several direct thrombin inhibitors have been studied as alternative anticoagulants in patients with HIT. Lepirudin and argatroban are both approved by the United States Food and Drug Administration (FDA) for the management of HIT. Lepirudin requires dosage adjustments in patients with renal insufficiency and has potential for antibody formation. Argatroban requires dosage adjustments in patients with hepatic insufficiency. Argatroban increases the international normalized ratio when coadministered with warfarin, leading to dosage difficulties when transitioning to warfarin therapy. Bivalirudin is the most recent direct thrombin inhibitor to be introduced to the market, but it is not currently FDA approved for HIT. Controversy stills exists over which direct thrombin inhibitor to use, especially in acutely ill patients and in those requiring invasive or surgical procedures. Bivalirudin has a relatively short half-life and a predictable response, which makes it attractive as an anticoagulant in patients requiring invasive or surgical procedures, those who are acutely ill, or patients with both renal and hepatic insufficiency. It offers promise as an additional direct thrombin inhibitor for use in patients with HIT, but additional studies need to be performed to further define its use.

Key Words: heparin-induced thrombocytopenia, HIT, bivalirudin, direct thrombin inhibitors.

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Resident Involvement in Teaching and Precepting

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RESEARCH

A Pharmacotherapy Scholars Program to Provide Intensive Training to Enhance Pharmacy Students' Postgraduate Readiness

James C. Coons, PharmD,[a,b] Neal Benedict, PharmD,[a,b] Amy Seybert, PharmD,[a,b] Carlo J. Iasella, PharmD, MPH,[a,b] Susan J. Skledar, MPH,[b] Randall M. Smith, PhD,[b] Melissa Saul, MS,[c] Christopher R. Ensor, PharmD[d]

[a] UPMC Presbyterian-Shadyside Hospital, Pittsburgh, Pennsylvania
[b] University of Pittsburgh School of Pharmacy, Pittsburgh, Pennsylvania
[c] University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania
[d] Florida Hospital Orlando, Orlando, Florida

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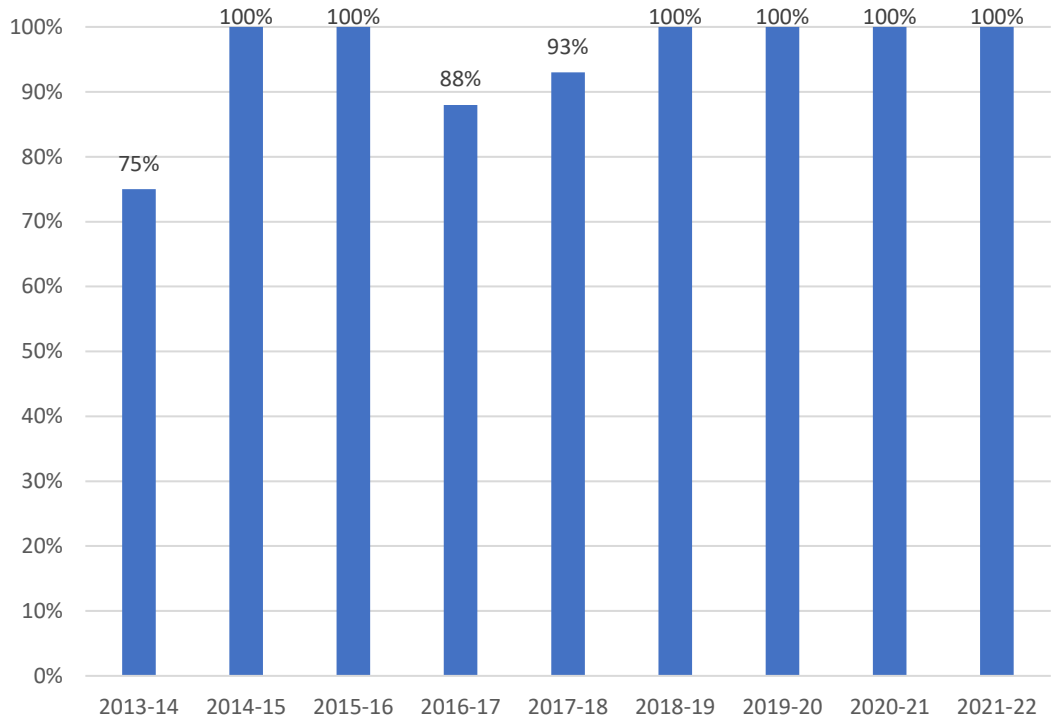
Residents' Roles in the Scholars Program

- Residents serve as primary preceptors and co-preceptors, throughout the P4 year of the program
- Residents provide clinical assessments, formative, and summative feedback
- Mentorship, career guidance, and guidance regarding post-graduate training

- PGY1 placement rate (n=123)



Other Ways To Enrich the Residency Experience

- Formulary, policy, protocol, and quality improvement
  - System P&T Anticoagulation Subcommittee
- Professional engagement and leadership
  - ACCP National Residency Advisory Committee Appointee
  - Travel awards
  - Abstract/poster presentations
  - Grant recipient – ASHP Foundation Resident Practice-Based Research Program

UPMC Pharmacy Residency Programs

Key Takeaways

1. Benefits of residency expansion to advance clinical pharmacy practice are evident through documentation of clinical outcomes, quality metrics, and favorable benefit-to-cost ratio

2. Residency growth and expansion of clinical services will help to ensure a workforce capable to meeting direct patient care roles in a cost-effective manner

3. At different residency programs, successful enhancements could be made through expansion and development of innovative services with residents

Questions?