

VA PHASER: Pharmacogenomic testing for Veterans— A collaboration between VA and Sanford Health

University of Arizona Pharmacogenomics and Precision Medicine
Symposium

January 17, 2020

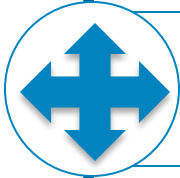
PHASER PROGRAM SUMMARY



The goal of pharmacogenetic testing (PGx) is to **reduce medication side effects, maximize medication benefits, and reduce opioid exposure** by using a patient's genetic makeup to ensure the right dose of the right drug



PGx impacts nearly **40 medications** commonly prescribed to Veterans



1 in 2 Veterans is prescribed a medication under pharmacogenetic control

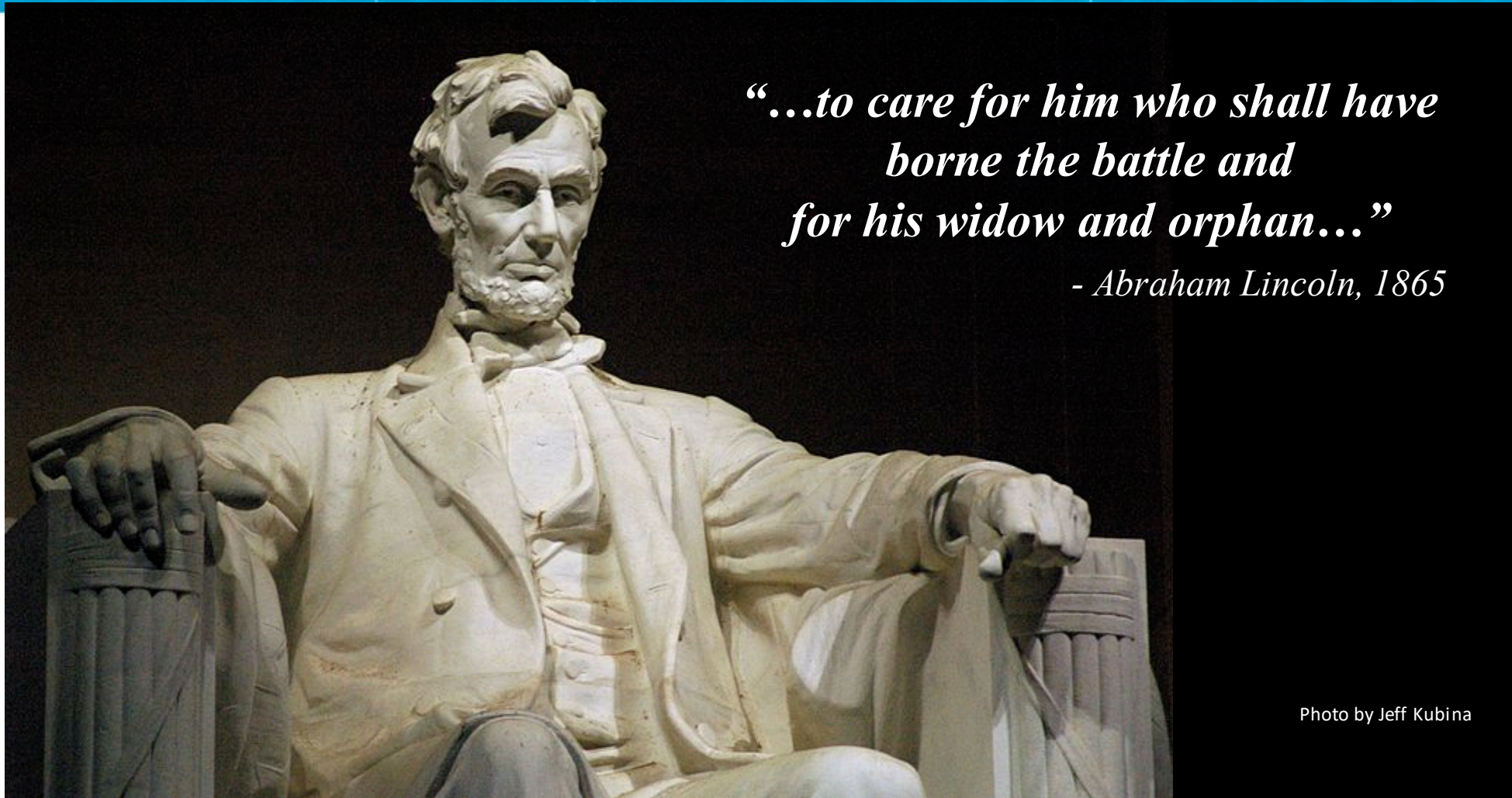
250k

Through a collaboration between VA and Sanford Health Care, PHASER will provide PGx to up to **250,000 Veteran patients over 4 years**



PHASER will be a **leader in the field of precision medicine** by being the largest implementation of PGx in the US in an integrated health care system

Mission of the U.S. Department of Veterans Affairs



*“...to care for him who shall have
borne the battle and
for his widow and orphan...”*

- Abraham Lincoln, 1865

Photo by Jeff Kubina



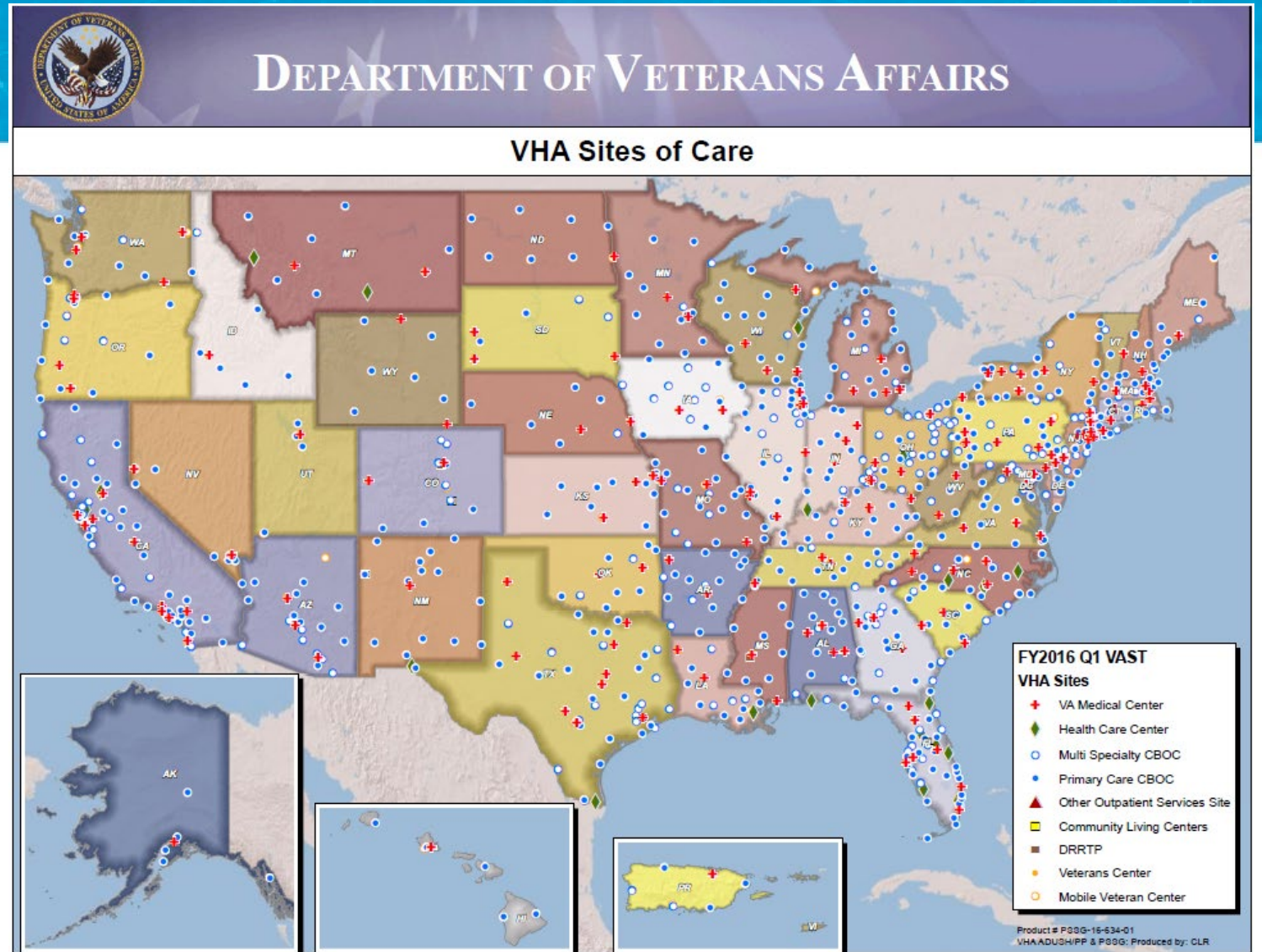
What is the U.S. Department of Veterans Affairs?

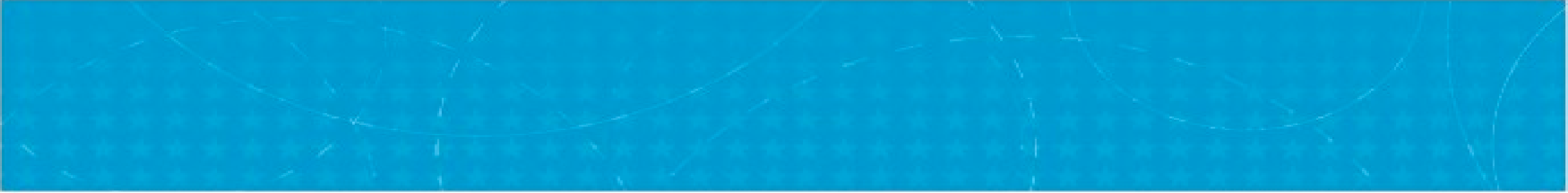
- Established in 1930
- Elevated to Cabinet level in 1989
- United States government's 2nd largest department after the Department of Defense
- Three components:
 - Veterans Health Administration (VHA)
 - Veterans Benefits Administration (VBA)
 - National Cemetery Administration (NCA)

1,227 Sites of care throughout the U.S.**

- 168 Medical Centers
- 1,047 Outpatient Clinics
- 135 Community Living Centers
- 113 Domiciliary Rehabilitation Treatment Programs
- 60 Mobile Sites of Care
- 300 Readjustment Counseling (Vet) Centers
- 80 Mobile Vet Centers

**NOTE: The number of sites of care is NOT a total of the categories listed below, as several of the sites are also listed in multiple categories (e.g., there are 135 CLCs within the 168 medical centers)

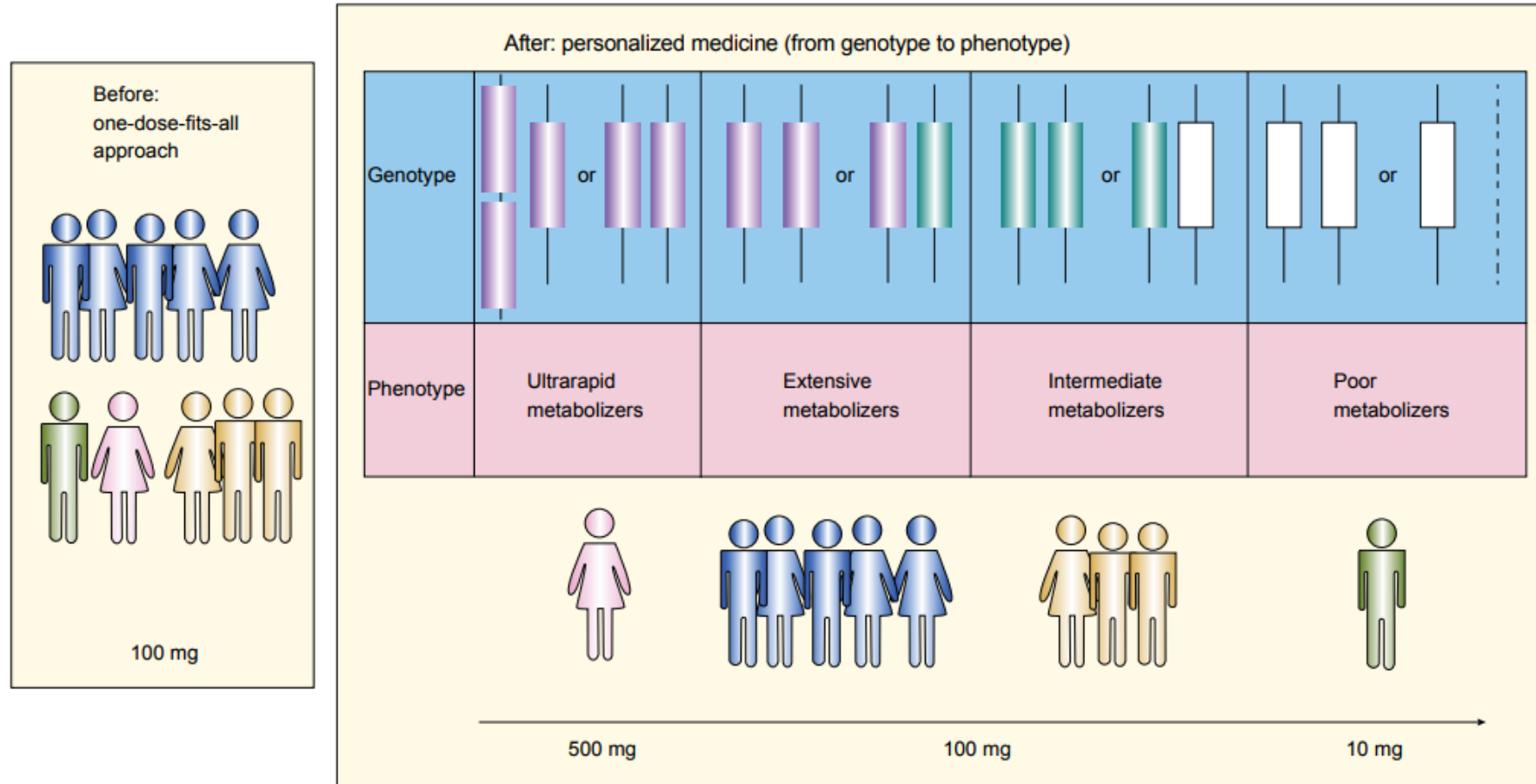




Why perform pharmacogenetic
testing in the VA?

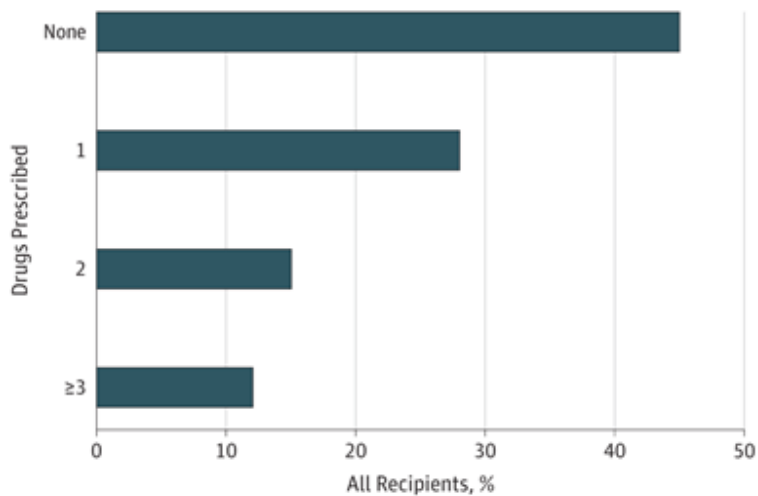
One-Drug Does Not Fit All

Genetic Variation in Drug Metabolizing Genes Can Be used to Individualize Drug Dose

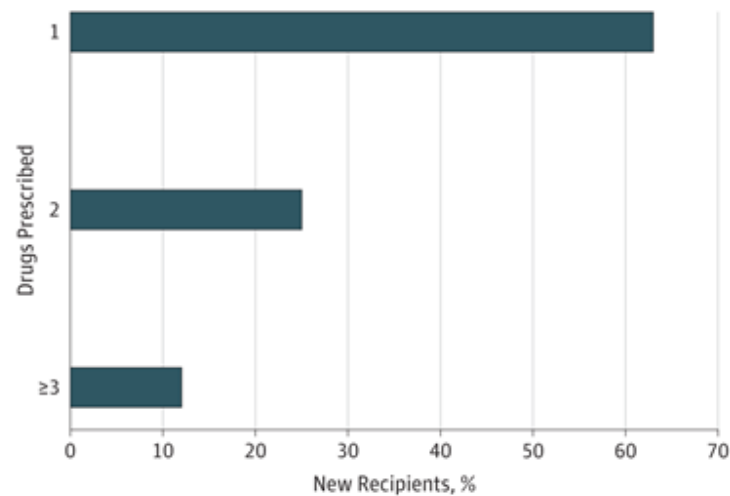


1 in 2 Veterans prescribed a medication under PGx control over 6 years: Analysis of 7.8 million Veterans using pharmacy benefits

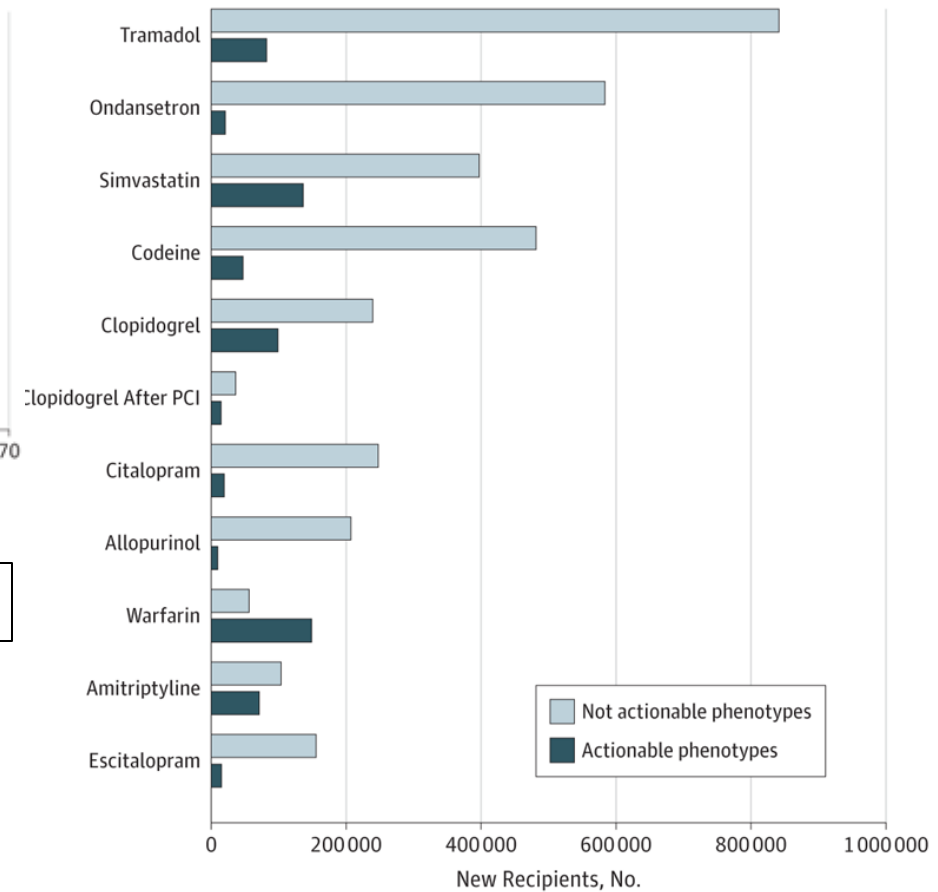
A Overall use of level A drugs



B New recipients of level A drugs



New recipients = 2.9 million





PHASER Goals

- PHASER is a clinical program (i.e., not research) offered through the VA Specialty Care Services and the National Oncology Program Office
- Sanford Health is supporting
 - Pharmacogenetic testing in Sanford Imagenetics laboratory in Sioux Falls, SD
 - Funding to the VA for implementation of the program
- The goal is to test 250,000 Veterans nationwide over 4-5 years and integrate test results into routine patient care.
- PHASER is distinct from the VA Million Veterans Program (biorepository)

Current PHASER Pharmacogenetics Panel

Collaboration with Sanford Health and Sanford Imagenetics Laboratory



Coming in February 2020: *IFNL3*,
CYP4F2, *CYP2C* cluster

Gene	Alleles tested
<i>CYP2C19</i>	*2*3*4*5*6*7*8*17
<i>CYP2C9</i>	*2*3*5*6*8*11
<i>CYP2D6</i>	*2*3*4*6*9*10*41
<i>CYP3A5</i>	*3*6*7
<i>DPYD</i>	*13*2A rs67376798
<i>SLCO1B1</i>	*1B*5*15*17
<i>TPMT</i>	*2*3A*3B*3C*4
<i>VKORC1</i>	-1639 A
<i>CYP2D6</i> copy number	within exon 9

What medications are impacted by the panel?

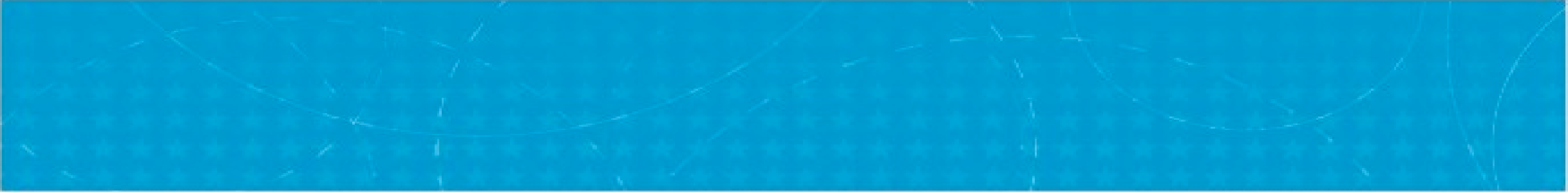
Drug List

Amitriptyline	Codeine	Imipramine	Ribavirin*	Trimipramine
Atomoxetine	Desipramine	Interferon, pegylated*	Sertraline	Tropisetron
Azathioprine	Doxepin	Mercaptopurine	Simvastatin	Voriconazole
Capecitabine	Escitalopram	Nortriptyline	Tacrolimus	Warfarin
Citalopram	Fluorouracil	Ondansetron	Tamoxifen	
Clomipramine	Fluvoxamine	Paroxetine	Thioguanine	
Clopidogrel	Fosphenytoin	Phenytoin	Tramadol	*coming soon



Who is eligible for PHASER?

- No inclusion criteria. Any Veteran can participate.
- We can send educational mailings to your patients ahead of an upcoming appointment.
- **PHASER testing is inappropriate in patients who have received bone marrow or liver transplantation**



What are the implementation barriers that we must address in order for PHASER to be successful?

Building on the shoulders of existing programs implementing pharmacogenomics

Successful pre-emptive pharmacogenomic testing US programs

- St. Jude's Children's Hospital
- Vanderbilt University
- University of Florida
- Mt. Sinai
- Mayo Clinic

Barriers to implementing pre-emptive pharmacogenetics in clinical practice

- Evidence base
 - Clinical validity
 - Clinical utility
 - Selecting appropriate PGx tests
- Guidelines directing clinical use of PGx test results
- Integrating genomic data into Electronic Health Record
- Physician/pharmacy awareness and education
- Implementing PGx into physician/pharmacy workflows
- Cost-consequences and reimbursement
- Scalability/translatability across and in-between facilities

PLoS Med. 2007 Aug;4(8):e209


JAMA. 2016;316(15):1533-1535.

CLINICAL PHARMACOLOGY & THERAPEUTICS VOLUME 101 NUMBER 3 | MARCH 2017

What is the evidence base supporting PGx informed prescribing?

CPIC – An evidenced based approach to developing PGx dosing guidelines

CPIC Summary

- Peer-reviewed, fully transparent, standards-based process to developing clinical guidelines based on all available evidence
- CPIC guidelines help clinicians understand HOW available genetic test results should be used to optimize drug therapy.
 - Not WHETHER tests should be ordered.
 - Meets PHASER use case 
- All guidelines produced in a standard format
 - Published in *Clinical Pharmacology and Therapeutics*
 - Freely available on

- Retrospective clinical trials
- Clinical cohorts
- Prospective trials/studies

In vitro

PK/PD

Consensus assessment of actionability of drug-gene interaction

Level Definitions for CPIC Genes/Drugs

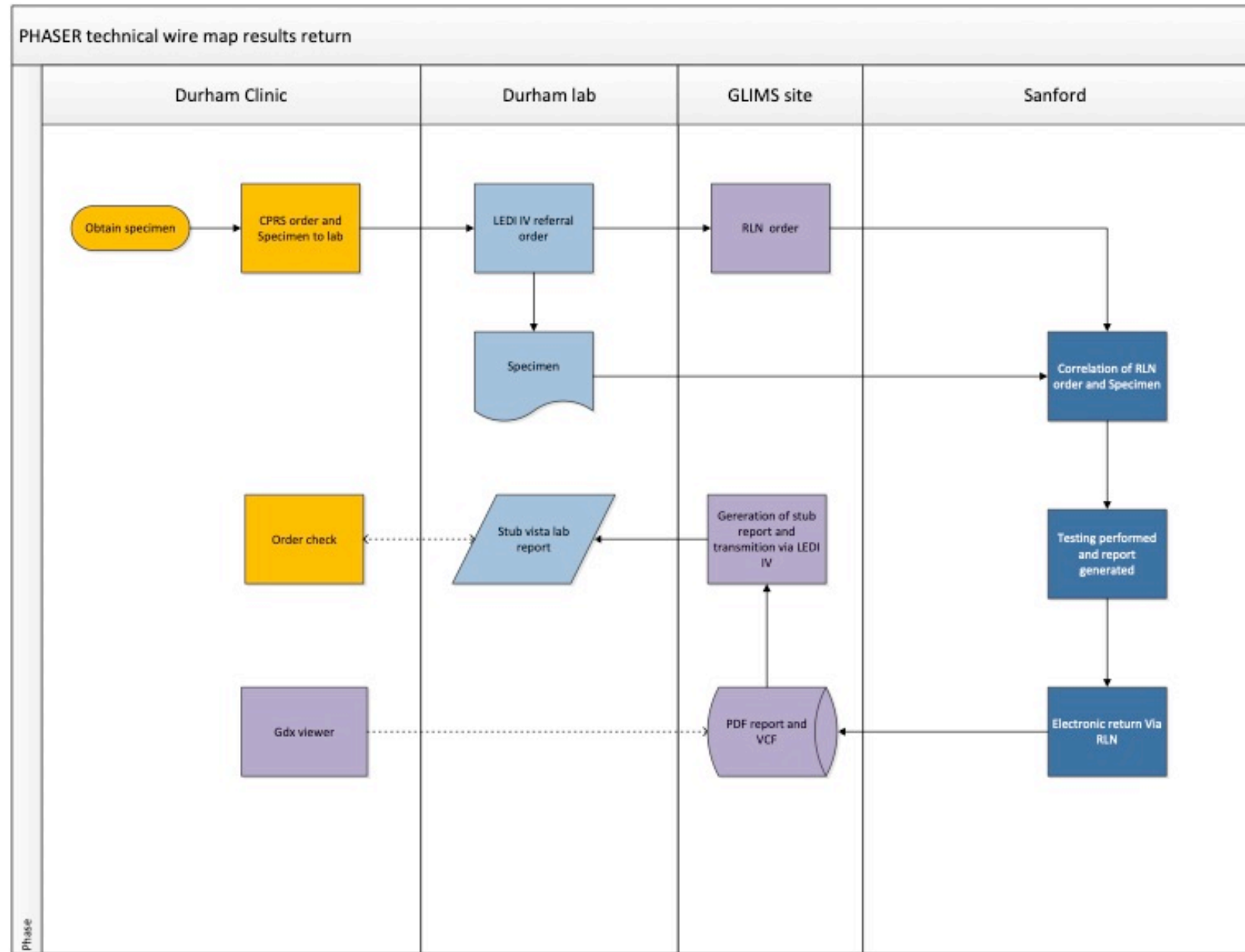
PHASER's focus

CPIC Level	Clinical Context	Level of evidence	Strength of Recommendation
A	Genetic information should be used to change prescribing of affected drug	Preponderance of evidence is high or moderate in favor of changing prescribing	At least one moderate or strong action (change in prescribing) recommended.
B	Genetic information could be used to change prescribing of the affected drug because alternative therapies/dosing are extremely likely to be as effective and as safe as non-genetically based dosing	Preponderance of evidence is weak with little conflicting data	At least one optional action (change in prescribing) is recommended.
C	There are published studies at varying levels of evidence, some with mechanistic rationale, but no prescribing actions are recommended because (a) dosing based on genetics convincingly makes no difference or (b) alternatives are unclear, possibly less effective, more toxic, or otherwise impractical. Most important for genes that are subject of other CPIC guidelines or genes that are commonly included in clinical or DTC tests.	Evidence levels can vary	No prescribing actions are recommended.
D	There are few published studies, clinical actions are unclear, little mechanistic basis, mostly weak evidence, or substantial conflicting data. If the genes are not widely tested for clinically, evaluations are not needed.	Evidence levels can vary	No prescribing actions are recommended.

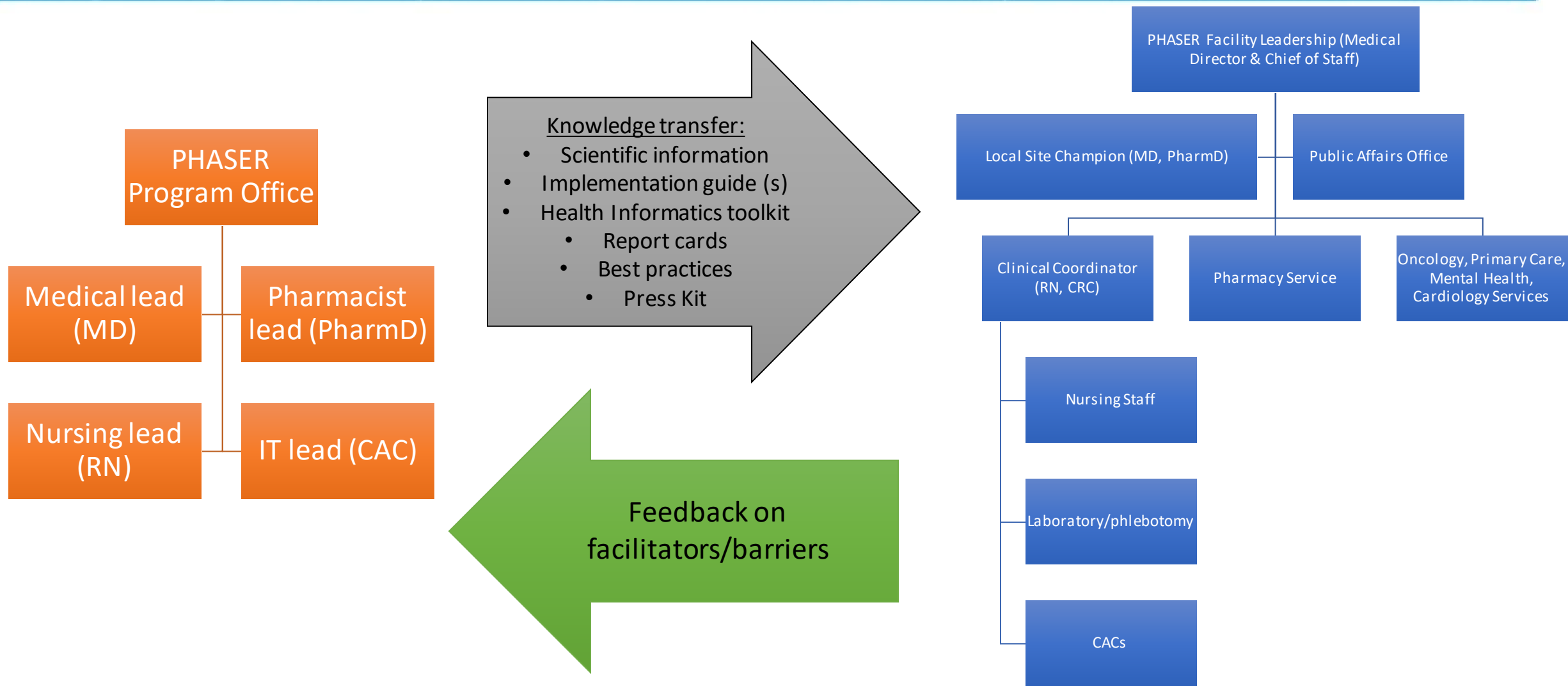
Bi-directional interface with PGx laboratory to store data as computable elements

- Coordination between:
 - Local VAs
 - Reference Laboratory Network
 - Sanford Health Imagenetics Laboratory
 - VA Health Information Technology

Courtesy Mike Icardi, MD



Train-the-trainer model of information diffusion

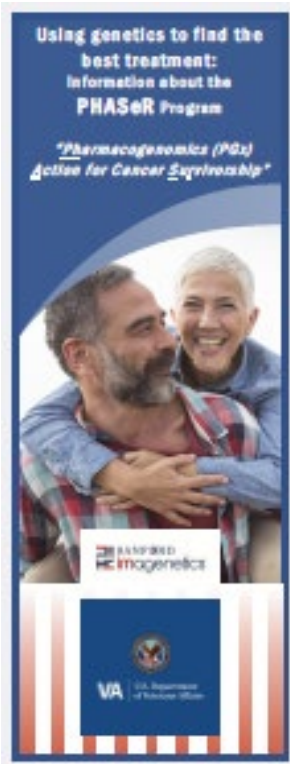


Pre-test patient education

Pre-test Video

Clinic Posters

Pre-appt. mailings



SANFORD
Imogenetics

VA U.S. Department of Veterans Affairs

New program offering genetic testing for veterans to inform decisions about your medications

FREQUENTLY ASKED QUESTIONS (FAQS) for the "Pharmacogenomics Action for Cancer Survivorship" (PHASER) Program.

Sanford Health and the U.S. Department of Veterans Affairs have teamed up to offer genetic testing to current VA health care system patients at no cost to the patient. We want to help your doctor find appropriate medications for a number of common health concerns, including pain, depression, anxiety and blood clotting.

What is genetic testing?
Genetic testing finds differences in genes that are related to your health. There are many different genetic tests. Genetic tests look for changes in your genetic makeup (DNA) that are linked to certain conditions, physical traits, disease risk or how you respond to medication.

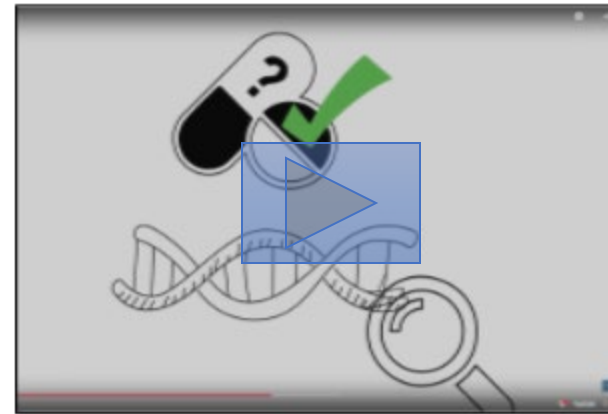
What type of genetic test does this program offer?
The type of genetic testing we're offering is a pharmacogenomic test. Pharmacogenomics, or PGx, determines how you respond to medication because of your genetics. Everyone responds to medicines differently, and sometimes these differences are due to gene changes. PGx testing uses your DNA to help your doctor determine prescription drugs that may work better for you. You can potentially reduce the trial-and-error process with certain medications, limit your side effects and get better drug responses by knowing the right drug at the right dose. This genetic test only provides information about your response to medicine. It does not provide information about the genetic risk of developing or recurring cancer, nor does it diagnose rare genetic diseases.

Who can get tested?
The genetic testing program launched in 2019 at the Durham VA Medical Center in Durham, North Carolina. The program plans to expand to all VA sites over time. Our goal is to test 250,000 U.S. veterans across 125 locations by 2022. Patients are not required to have a previous cancer diagnosis or any other diagnosis to participate.

What will this cost?
This program comes at no cost for veterans or taxpayers due to a generous \$25 million gift from philanthropist Denny Sanford and a matching fundraising effort from Sanford Health. Although the test itself will be provided at no cost to VA patients, standard co-payments for regular doctor visits and medications prescribed by their doctors are not covered.

How does this test help my doctor make better decisions when prescribing medications?
The test results will go back to your doctor with information on how your genetic profile may affect your body's response to several commonly prescribed medications. This information, along with other factors specific to you, can help your doctor when prescribing your medications.

What if new drugs come out or new information is learned in the future for the genes tested?
There's no need for additional testing if the new drug or information is related to the genes we looked at with this PGx test. We'll simply update your VA medical records with the new information.



**Using genetics to find the best treatment:
Information about the PHASeR Program**
"Pharmacogenomics Action for Cancer Survivorship"



About PHASeR:
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Who can get tested?
Current VA patients at no extra cost.

Interested, eligible, and want to know more? Please talk to your VA doctor about this test, or visit our website for additional information.

For more information, visit our website at:
<https://imogenetics.sanfordhealth.org/veterans-genetic-testing>



U.S. Department of Veterans Affairs

Get help from Veterans Crisis Line

Health Benefits Burials & Memorials About VA Resources Media Room Locations Contact Us

VA » Health Care » National Oncology Program Office » Programs » Announcements » PHASeR Program

National Oncology Program Office

PHASeR Program



QUICK LINKS

- Hospital Locator
- Health Programs
- Protect Your Health
- A-Z Health Topics

RESOURCES

- Home
- FAQs
- Patient Information
- Provider Information

CONTACT

National Oncology Program Office
Phaser Program
Durham, NC 27705
cancer@va.gov

SOCIAL MEDIA

Twitter
#geneticstestingforvets
#pharmacogenetics

PHASeR (Pharmacogenomics Action for Cancer Survivorship) - PGx Testing

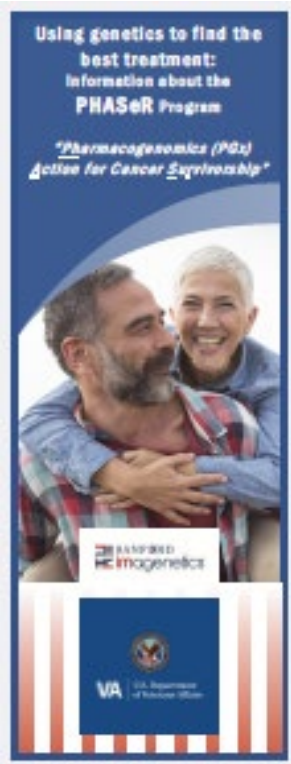

A New Program Offering Genetic Testing for Veterans to Inform Decisions About Their Medications

Overview
In Spring 2019, Sanford Health and the U.S. Department of Veterans Affairs teamed up to offer pharmacogenomic (PGx) testing through a program called

Website

Post-test patient education to support PHASER

Post-test mailings

SANFORD
Imogenetics

VA U.S. Department of Veterans Affairs

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Post-test Video



Test Details

Gene	Genotype	Phenotype	Alleles Tested
CYP2C19	*1/*17	Rapid Metabolizer	*2, *3, *4, *4B, *5, *6, *7, *8, *17
CYP2C9	*1/*3	Intermediate Metabolizer	*2, *3
CYP2D6	*2/*10	Normal Metabolizer	*2, *3, *4, *4M, *6, *8, *9, *10, *17, *29, *41
CYP3A5	*3/*3	Poor Metabolizer	*3, *3C, *6, *7
DPYD	*1/*1	Normal Metabolizer	*2A, rs67376798 A, *13
SLCO1B1	*1/*5	Decreased Function	521T>C, 388A>G, -11187G>A
TPMT	*1/*3A or *3B/*3C	Intermediate or Poor Metabolizer	*2, *3A, *3B, *3C, *4
VKORC1 and CYP2C9	-1639G>A G/G, *1/*3	Intermediate Warfarin Sensitivity	-1639G>A

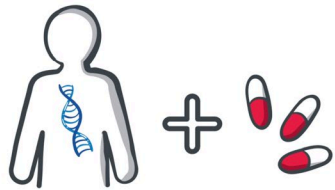
Provider Training opportunities to support PHASER

Grand Rounds, morning-meeting, noon conference type sessions:

- Providers
- Nurses
- Pharmacists

Pre-test Videos

What is pharmacogenomics (PGx)?



Online CE module

PHASER - Overview and Videos
(VA 4527522)

TALENT MANAGEMENT SYSTEM 2.0

Start Course More

Post-test videos



Quarterly newsletter

PHASER Director's Message
Volume: 1
Date: July 2018

PHASER
Pharmacogenomics (PGx) Action for
Cancer Survivorship

SANFORD
imogenetics

VA

PHASER: A collaboration in PGx to help Veterans.

By Alisa Korte (Updated version. Originally posted Mar 12, 2018 at <https://www.va.gov/opa/pressrel/pressrel.asp?collaborationpgxhelpveterans>. Reprinted with permission.)

There are about 15 million cancer survivors in the United States, about 400,000 of them are also veterans in the Veterans Affairs (VA) system. As more people survive cancer, their medication needs go beyond their cancer treatment. For veterans, VA physicians hope to bring more personalization to cancer survivorship plans for patients with pharmacogenomic testing.

Pharmacogenomics (PGx) analyzes the inherited genetic differences in drug metabolic pathways to see how an individual may respond to drugs, both in terms of therapeutic and adverse effects. PHASER (Pharmacogenomics Action for Cancer Survivorship) (PHASER) is a new collaboration between the VA and Sanford Health Care in Sioux Falls, South Dakota that will use PGx testing on veterans to provide prescriptive testing.

Deepak Vora, M.D., associate professor of medicine, will serve as director for PHASER. This collaboration is funded entirely through a \$20 million gift from philanthropist Denny Sanford, for whom the health system is named.

This testing is prescriptive, which means a patient may not need any medication at the time of testing. Instead, this test will provide helpful information to include in their electronic health records, so about the need arise in the future, this information will be readily available to their healthcare professionals.

"When physicians order specific medications," Vora said, "this system would be working in the background to check patients' genetic profiles and alert physicians to any issues."

Initially, PHASER participants were military veteran cancer survivors. Cancer survivors are at a greater risk of chronic mental health issues, metabolic disease, and chronic pain.

Using PGx testing could help reduce medication side effects, maximize medication benefits and reduce hospital exposure by using a patient's genetic make-up to ensure the right dose of the right drug. The program has since expanded to all VA patients.

This should take some of the guesswork out of prescribing drugs to patients. Currently, there is some trial and error in figuring out the best medication for patients. For example, a person being treated for depression may have to try several different drugs before finding the one that helps the most. Since it takes 4-6 weeks to cycle through each drug to see its efficacy, a patient could continue to struggle with depression for months before finding relief. By using PGx testing, a healthcare provider could find the best drug with


March 12, 2018. Deepak Vora, MD, indicates the results of a genetic test. Photo by: Michael L. Vora. VA and Sanford Health Care announced the PHASER program.

"By using PGx testing, a healthcare provider could find the best drug with the fewest side-effects for each individual patient faster, which in turn, will create better outcomes, satisfaction and drug adherence for the patients!"

Passive clinical decision support systems (CDSS) to incorporate PGx *during decision making*

“Traffic light” PDF report based on CPIC guidelines

“On the fly” PGx interpretation



PATIENT INFORMATION

NAME: CARMEN RESEARCH3
MRN: F2717
DOB: 1/18/1979
SEX: Female

Potentially impacted Medications

CATEGORY	DRUG CLASS	STANDARD PRECAUTIONS	USE WITH CAUTION	CONSIDER ALTERNATIVES
Cardiovascular	Antiplatelets	Prasugrel (Effient) Ticagrelor (Brilinta) Vorapaxar (Zontivity)	Clopidogrel (Plavix)	
	Beta Blockers	Carvedilol (Coreg) Labetalol (Normodyne, Trandate) Metoprolol (Lopressor) Nebivolol (Bystolic) Propranolol (Inderal) Timolol (Timoptic)		
	Diuretics	Torsemide (Demalex)		
	Statins		Atorvastatin (Lipitor) Fluvastatin (Lescol) Lovastatin (Mevacor, Altoprev, Advicor) Pitavastatin (Livalo) Pravastatin (Pravachol) Rosuvastatin (Crestor)	Simvastatin (Zocor)

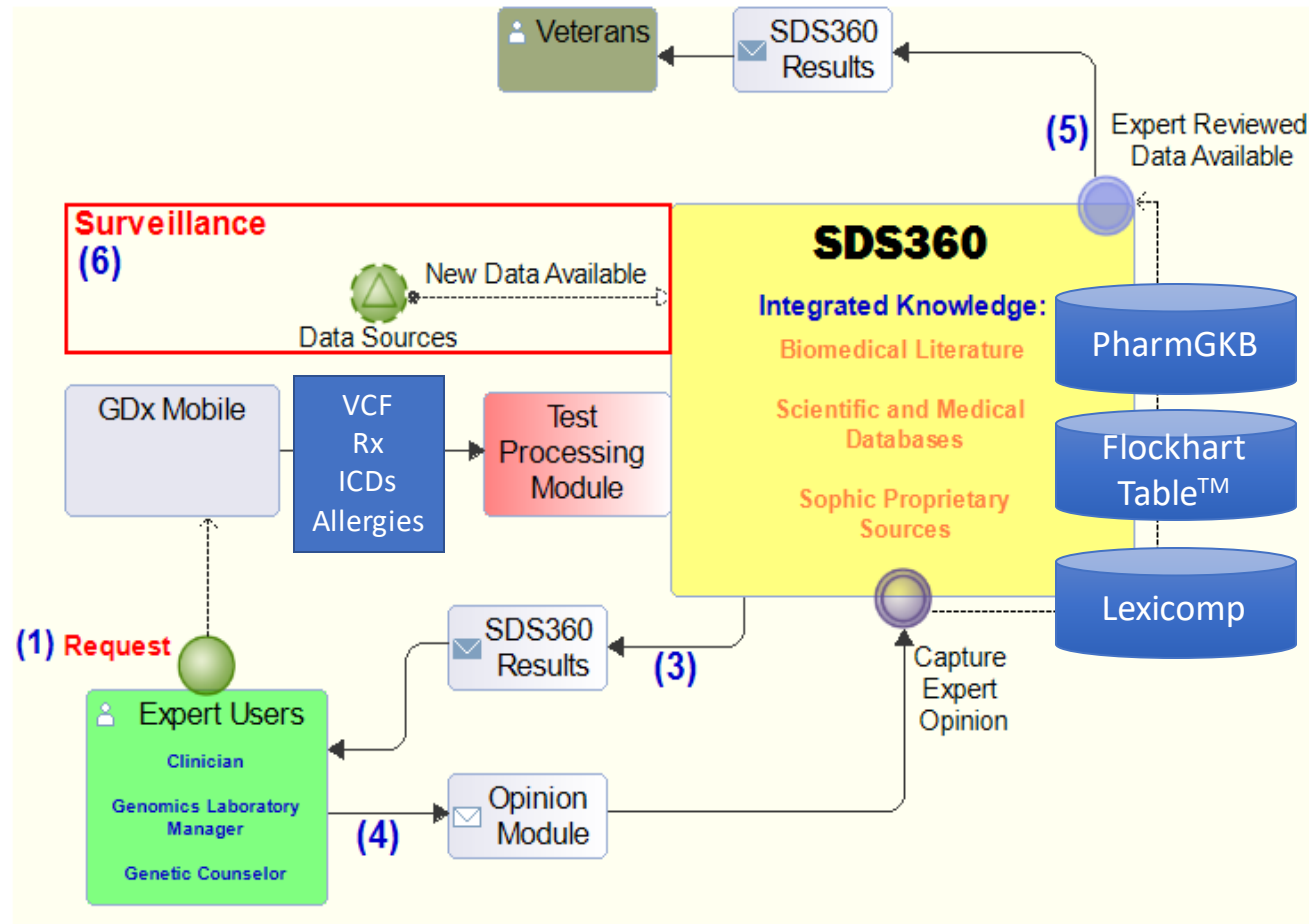
Gene: CYP2D6
Result: Ultrarapid metabolizer
Drugs impacted:
- Codeine
- Desipramine
- Fluvoxamine
- Nortriptyline
- Ondansetron
- Paroxetine
- Tramadol

Drugs impacted based on CYP2C19 and CYP2D6 results

- Amitriptyline
- Clomipramine
- Doxepin
- Imipramine
- Trimipramine

Gene: CYP2C9
Result: Intermediate metabolizer
Drug impacted:
- Phenytoin

Enabling deeper interpretation of PGx test results by linking to external databases



GDx collaboration (Constance Murphy, Julie Lynch, Mike Icardi) and SDS360 software

- Cloud based re-interpretation
- Leverage literature, ontologies, clinical data libraries
- Ability to 'socialize' knowledge and interpretations
- Customized views (pathology, oncology, pharmacy, etc.)





Interruptive CDSS incorporate PGx *after decision making* – Best for highest risk interactions

- Will allow for checking gene-drug interactions during ordering
- Alert provider to the potential nature and severity of interaction
- Offer alternatives (dose or drug selection)
- Can be overridden by provider with reasons
- If no interaction → no interruption in workflow
- Current CROC examples
 - Metformin and CrCl check
 - ACEi/ARB and women of childbearing age check

Outpatient Medications

CLOPIDOGREL TAB Change

Dosage	Complex	Tier	Route	Schedule	PRN
75MG	\$0.041	Tier 1	BY MOUTH	DAILY	<input type="checkbox"/>
75MG	\$0.041		BY MOUTH		
150MG	\$0.081		MOUTH	5XD	
			NG TUBE	6XD	
			ORAL	AC	
				AC&HS	
				BEFORE BREAKFAST	
				BEFORE LUNCH	
				BEFORE SUPPER	
				BID	
				BIDI	
				BIDRES	
				CONTINUOUS VIA PUMP	
				DAILY	
				DAILY INSULIN "INPT"	
				DAILY RESP "INPT"	
				EVERY OTHER EVENING	
				EVERY OTHER MORNING	
				EVERY OTHER@HS	
				FOR HYPOLYCEMIA	
				FOR IMAGING SCAN	
				LOVENOX INJECTIONS	
				MO@0900	
				MO@2100	
				MO-FR@0900	

Comments:

>> Quantity Dispensed: TAB <<

Days Supply: 90 Qty (TAB): 90 Refills: 0

Pick Up: Clinic Mail Window

Priority: ROUTINE

RESTR TO ER, NEUROLOGY, CARDIOLOGY, PRIME CARE & INTERVENTIONALISTS

CLOPIDOGREL TAB 75MG
TAKE ONE TABLET BY MOUTH EVERY DAY
Quantity: 90 Refills: 0

Accept Order Quit

Order Checking

(1 of 1) Sue Test

Health factor 'CYP2C19 POOR METABOLIZER' found. Patient has CLOPIDERCOL order and CYP219 GENOME TEST RESULT 'CYP2C19 POOR METABOLIZER' choose alternative drug (ticagrelor or prasugrel) and discontinue original clopidogrel order!

Accept Order Cancel Order Drug Interaction Monograph

Order Checks

To cancel an order select the order by checking the checkbox and press the "Cancel Checked Order(s)" button.

If the order check description is cut short, hover over the text to view the complete description.

Cancel	Order/Order Check Test
<input type="checkbox"/>	CLOPIDOGREL TAB 75MG TAKE ONE TABLET BY MOUTH EVERY DAY Quantity: 90 Refills: 0 *UNSIGNED*

*Order Check requires Reason for Override

(1 of 1) Sue Test

Health factor 'CYP2C19 POOR METABOLIZER' found. Patient has CLOPIDERCOL order and CYP219 GENOME TEST RESULT 'CYP2C19 POOR METABOLIZER' choose alternative drug (ticagrelor or prasugrel) and discontinue original clopidogrel order!

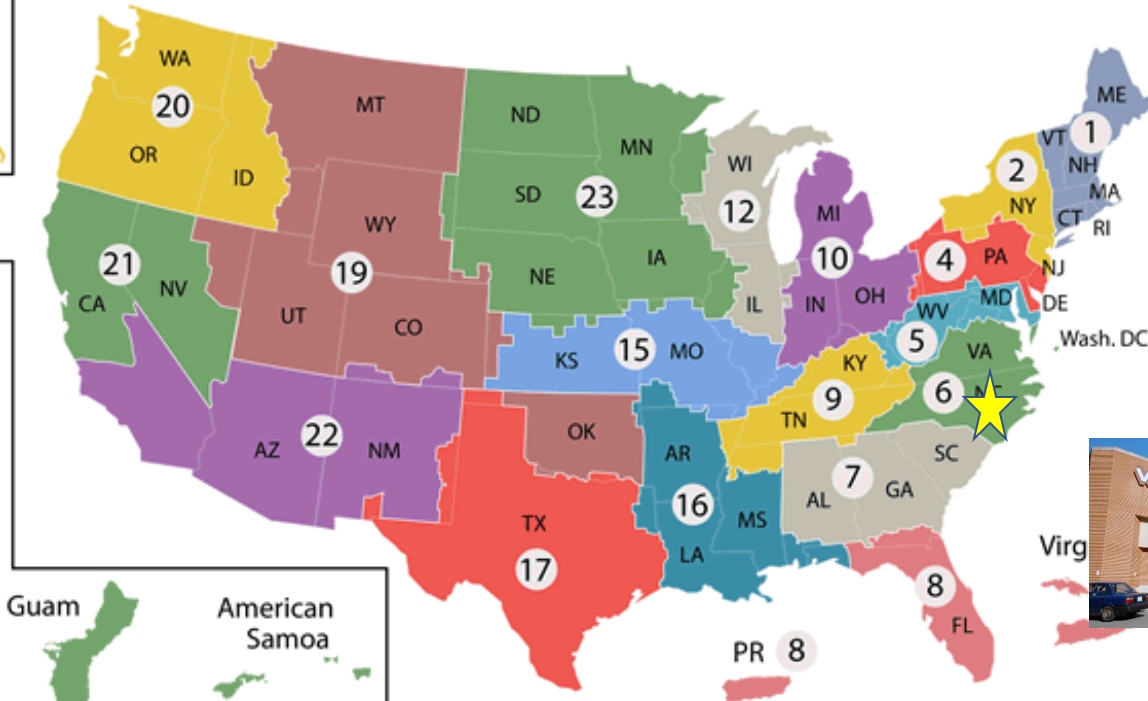
Cancel Checked Order(s) NOTE: The override reason is for tracking purposes and does not change or place new order(s).

Enter reason for overriding order checks:

Accept Order(s) Return to Orders Drug Interaction Monograph

Clinical Reminder Order Checks to Provide Clinical Decision Support at the Point of Prescription

National interfacility consultations with PHASER pharmacist

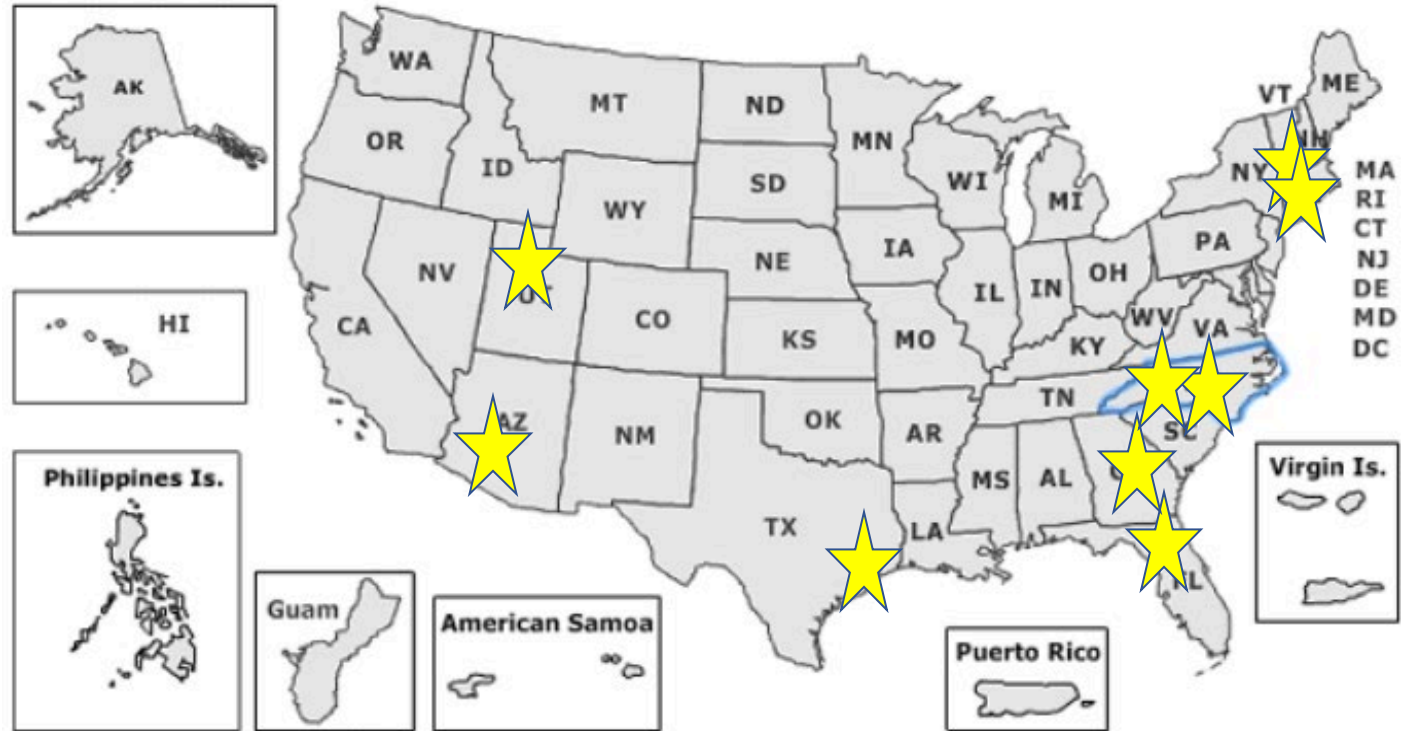


- Pre-test consultation (in reactive/diagnostic cases)
- Post-test consultation
- Medication reconciliation of active medications at time of PGx testing
- Comprehensive medication management in context of PGx

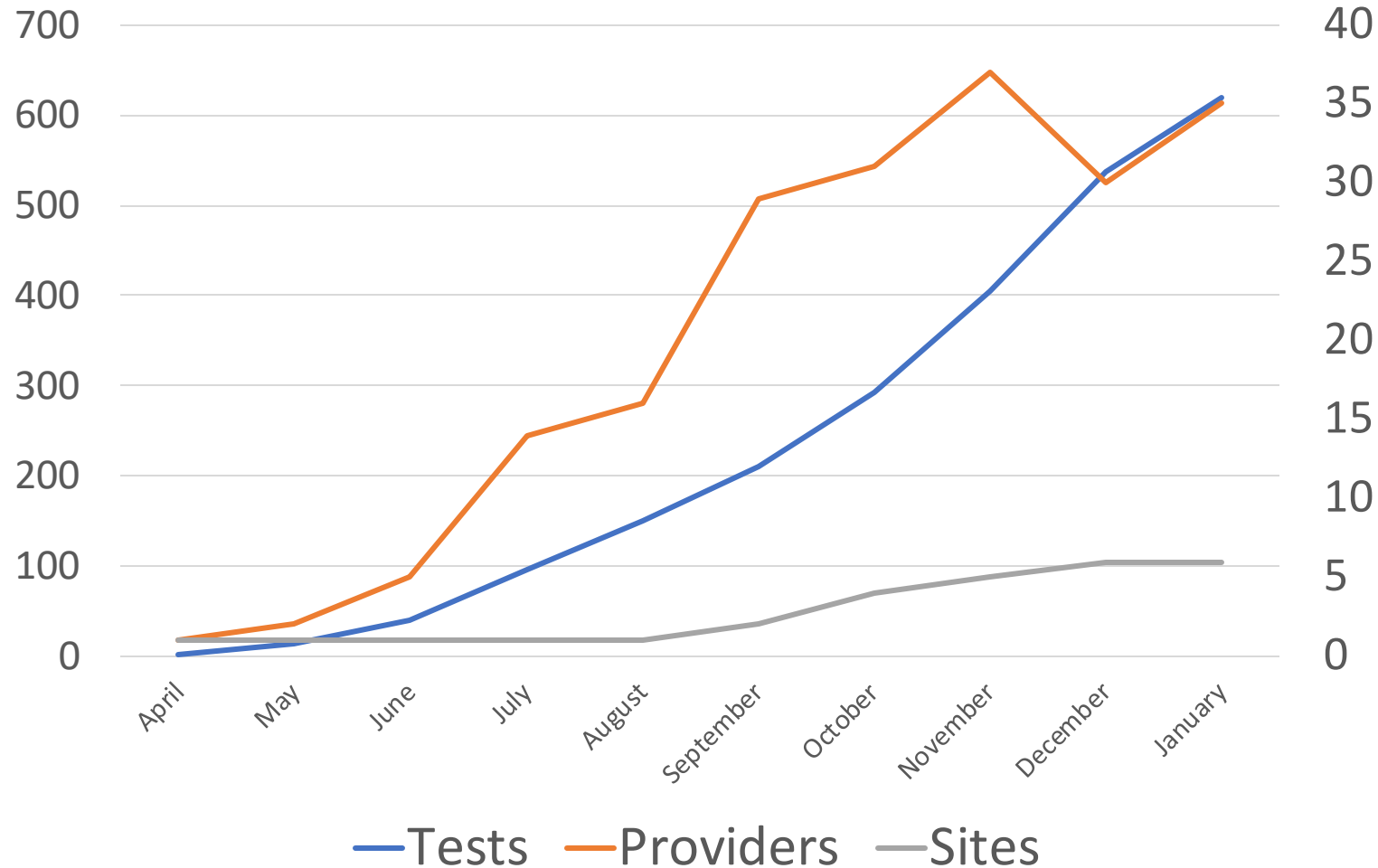


Jill Bates, PharmD, MS, BCOP, FASHP
Pharmacy Program Manager

PHASER snapshot 2019

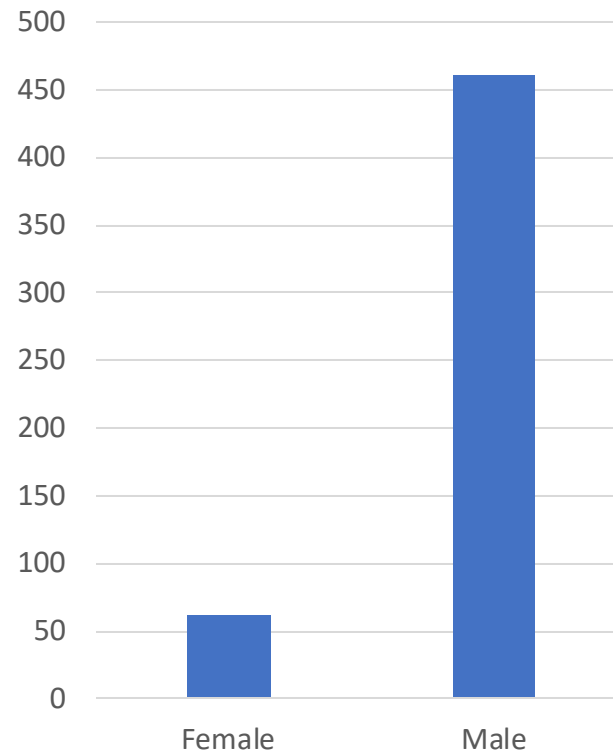
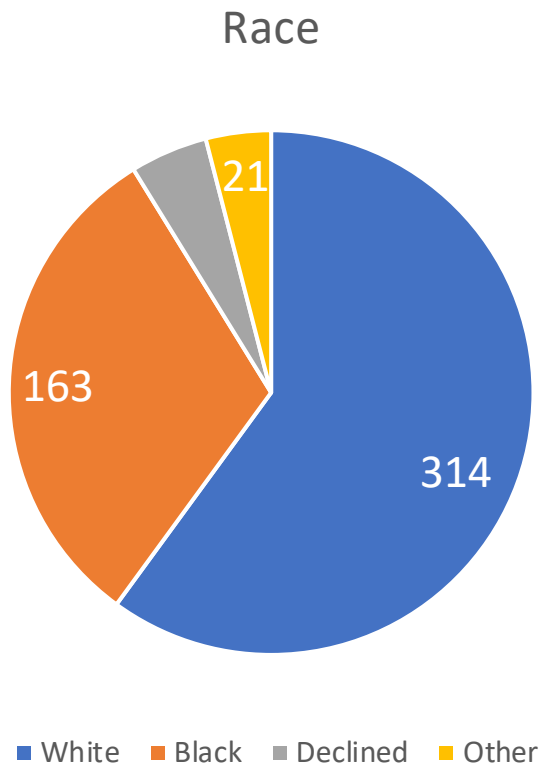


Overall characteristics since inception



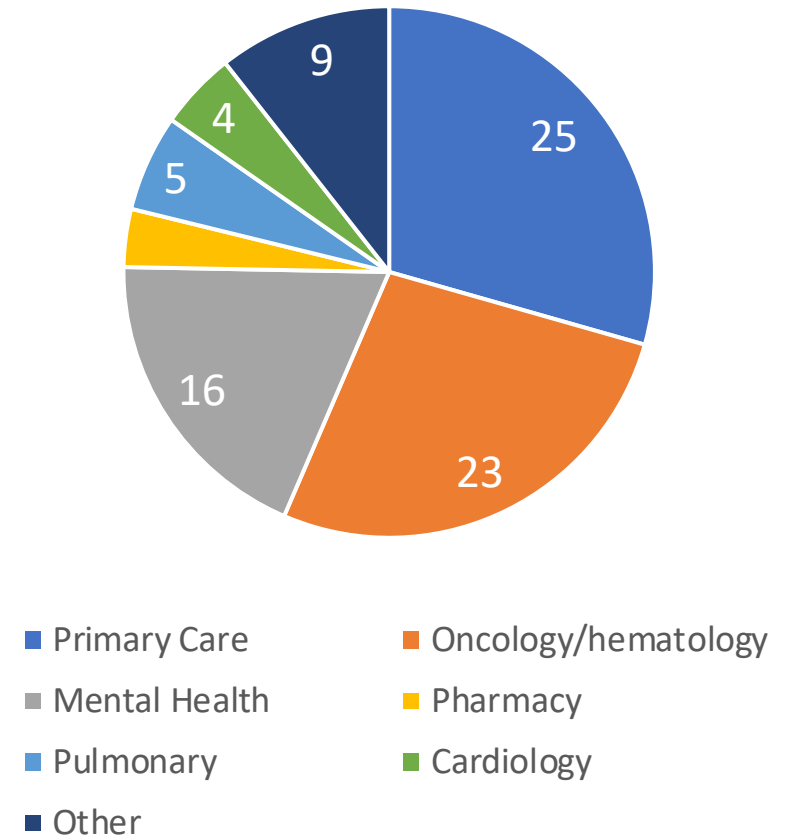
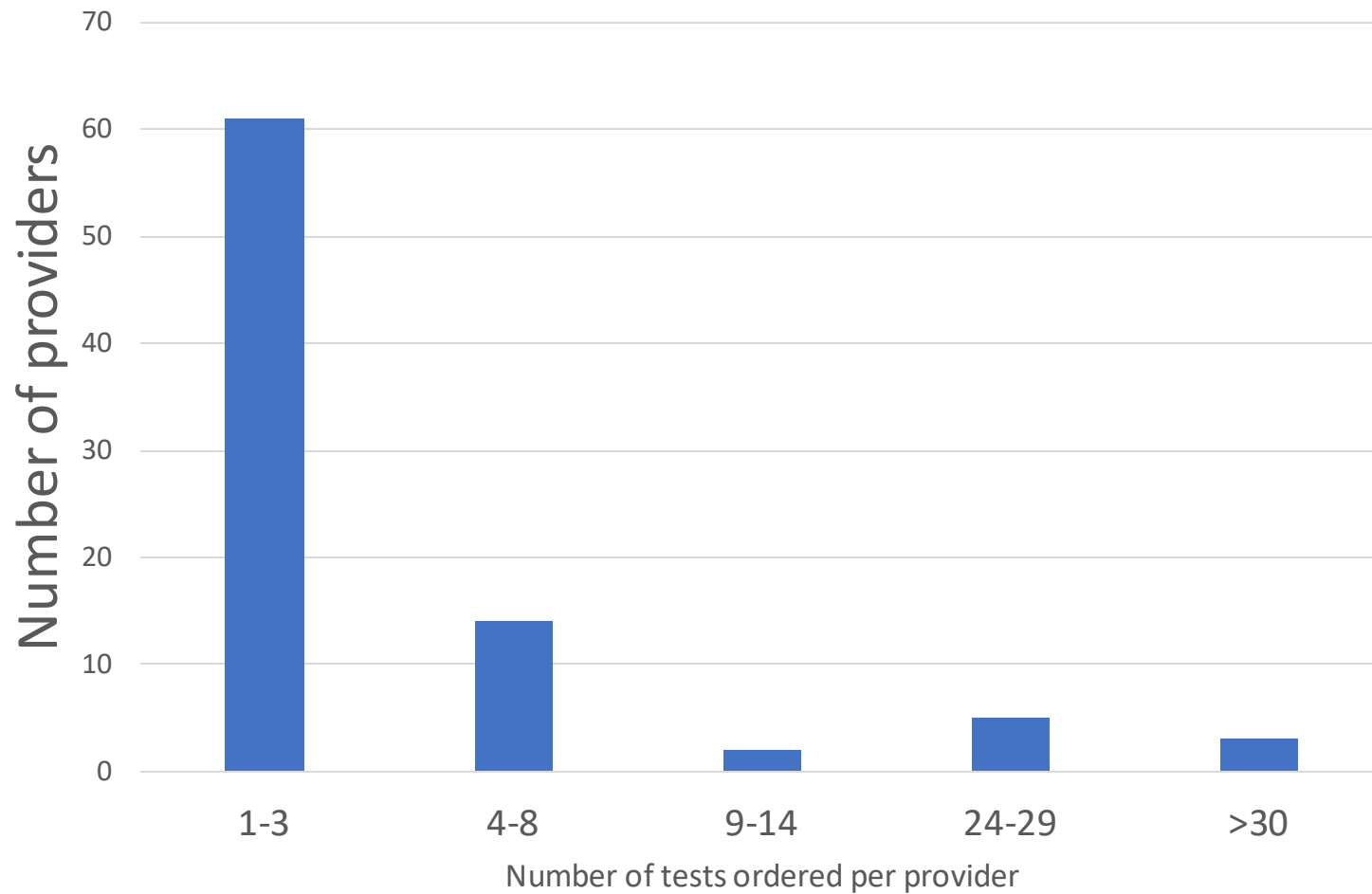
Median turnaround time = 16 days

Patient characteristics



Average age = 65 years

Provider characteristics

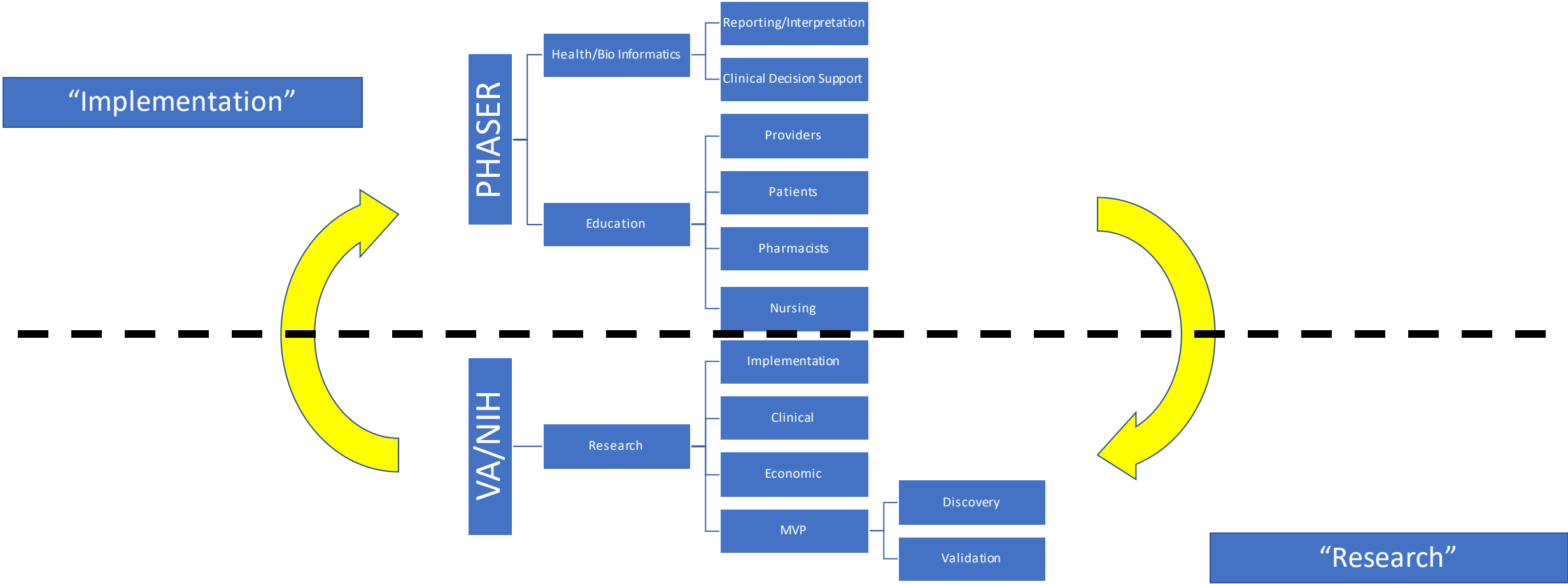




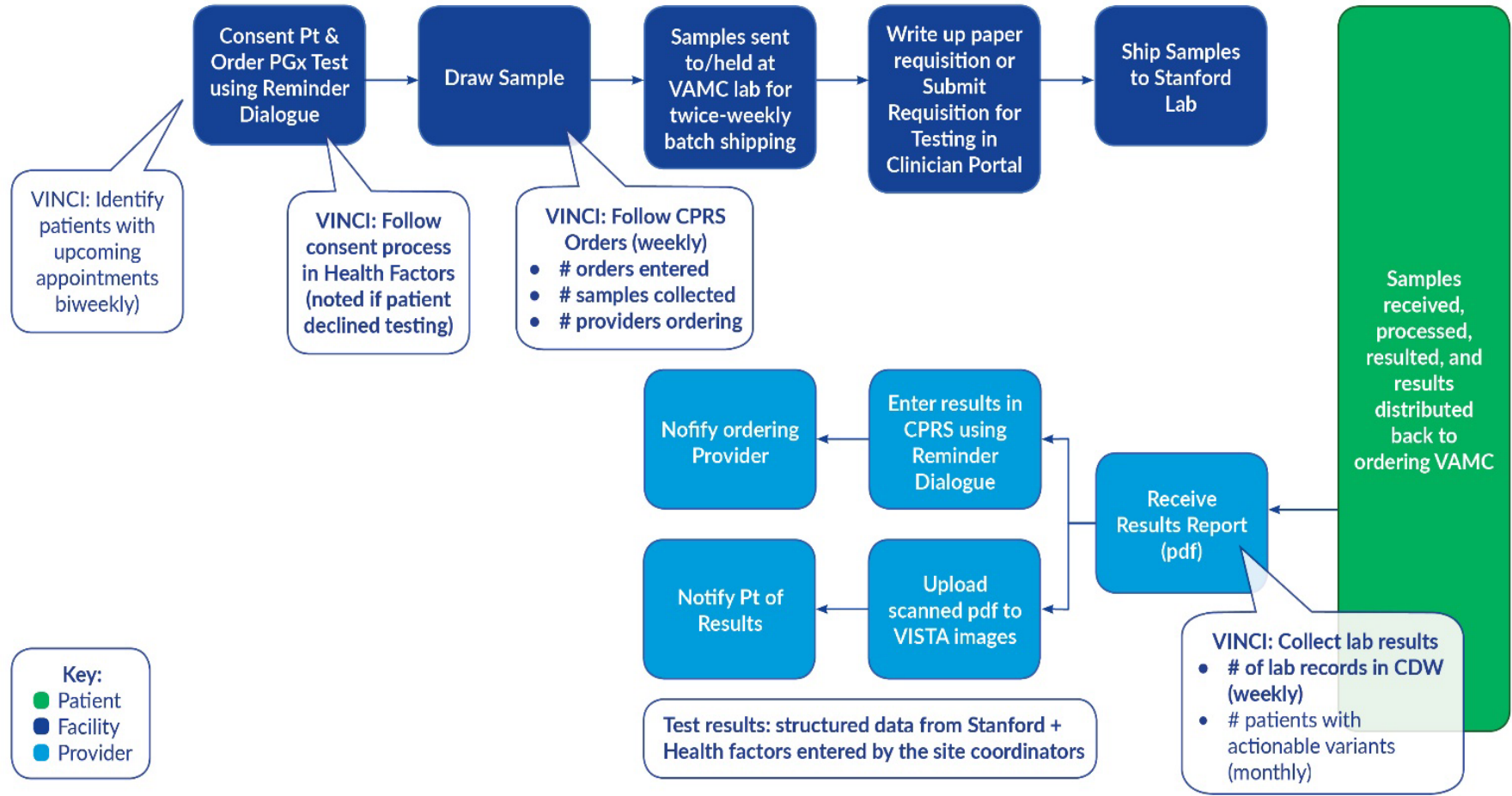
PHASER Outcomes and Research Opportunities

Collect and analyze uptake and use of PGx data during implementation

Learning Health System



Data flow to support PHASER



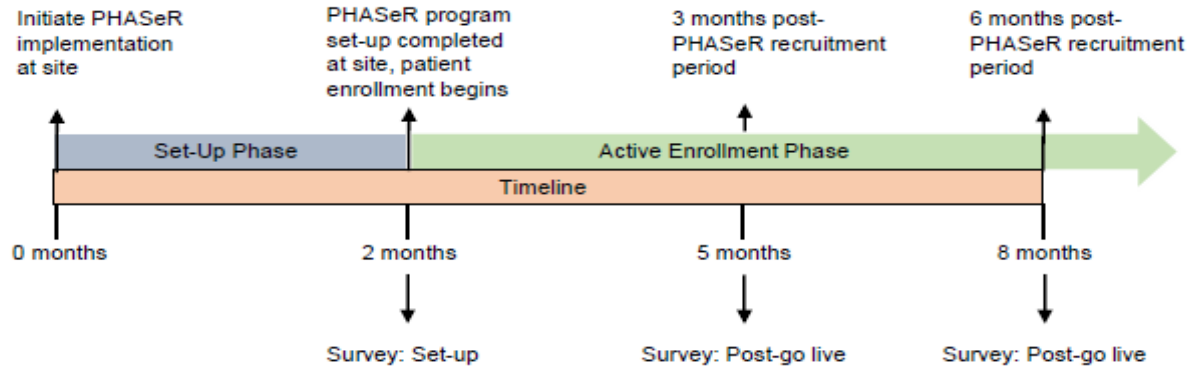
Catherine Chanfreau, PhD
 Director, PHASER data core

Outcomes of interest for retrospective research

Type	Description	Example (s)
Process	Steps in a process that lead to a health outcome	CROC acceptance vs. override
Intermediate	A biomarker associated with a health outcome	LDL for statins, INR for warfarin, cell counts for thiopurines.
Health	Health outcome which is attributable to PGx testing	New report of allergy/intolerance to medication, hospitalization for bleeding, cytopenia, etc.
Cost	Costs associated with intervention and health states experienced by patient.	Cost of testing, PHASER infrastructure, costs of care related to PGx (i.e. meds, testing), utilization (hospitalization, visits, calls, consults)
Behavior (individual and health system)	Change in patient/provider behavior	Adherence to medications, adherence to guidelines for specific medication classes, concordance of new prescriptions with PGx recommendations

Using implementation science to optimize uptake

Summary of survey collection time points at each VA site



Key Personnel	Set-up	Post-go live
Site champs/coordinator	x	x
VA lab	x	x
Sanford lab (Linda Berg)	x	x
CAC/LIM	x	
Provider (active – consented patients)		x
Provider (inactive – attended in-services but have not consented patients)		x

- Goals: Use established frameworks to evaluate
- Program materials
 - Resource utilization and costs
 - Implementation processes



Olivia Dong, PhD

Leveraging VA's Biorepository

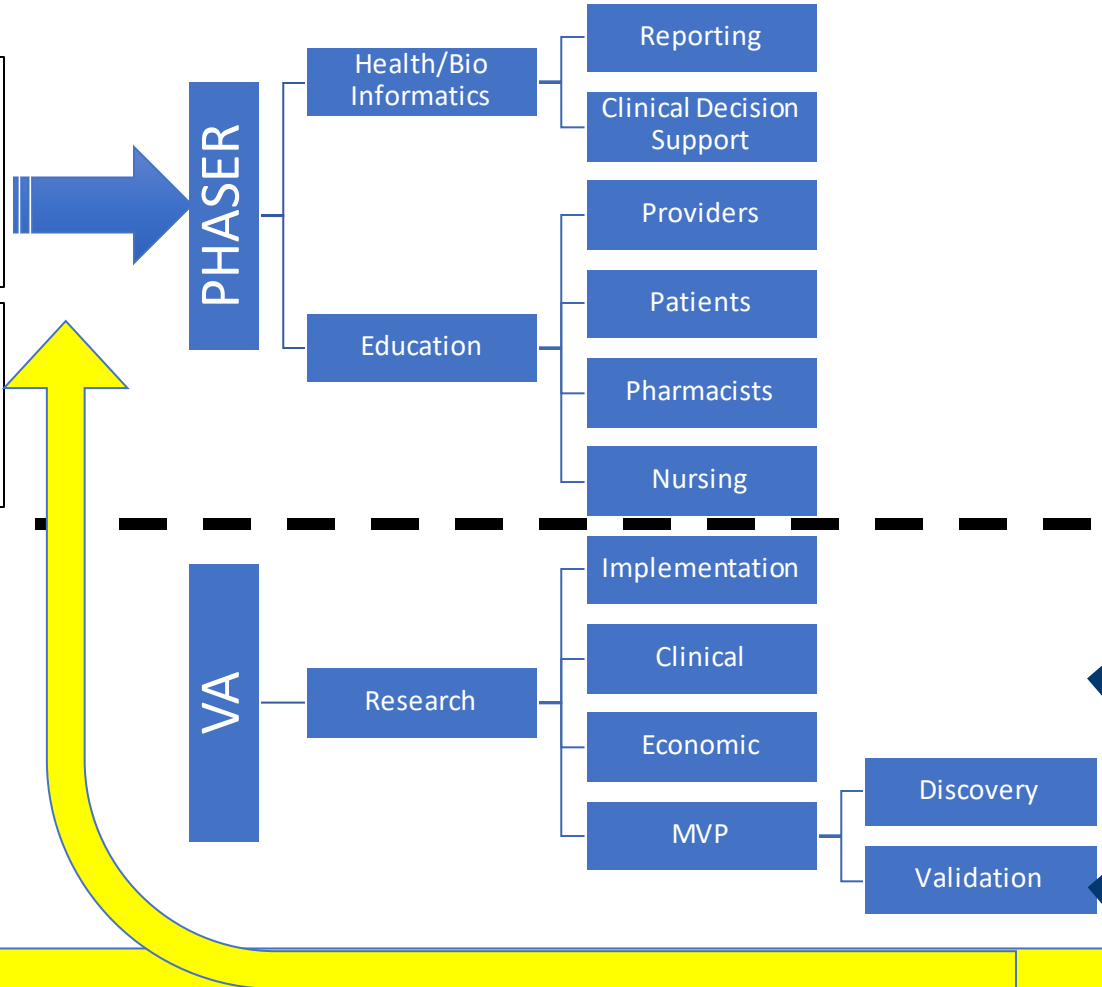


The Clinical Pharmacogenetics Implementation Consortium Guideline for *SLCO1B1* and Simvastatin-Induced Myopathy: 2014 Update

LB Ramsey¹, SG Johnson^{2,3}, KE Caudle¹, CE Haidar¹, D Voora⁴, RA Wilke^{5,6}, WD Maxwell⁷, HL McLeod⁸, RM Krauss⁹, DM Roden^{10,11}, Q Feng^{10,11}, RM Cooper-DeHoff¹², L Gong¹³, TE Klein¹³, M Wadelius¹⁴ and M Niemi^{15,16}

Clinical Pharmacogenetics Implementation Consortium Guidelines for *CYP2C19* Genotype and Clopidogrel Therapy: 2013 Update

SA Scott¹, K Sangkuhl², CM Stein³, J-S Hulot^{4,5}, JL Mega⁶, DM Roden⁷, TE Klein², MS Sabatine⁶, JA Johnson^{8,9,10} and AR Shuldiner^{11,12}



MVP MILLION VETERAN PROGRAM

Phenotyping statin-associated musculoskeletal symptoms in MVP for genetic association studies

Kyoung Min Lee, PhD; Austin Willard, PhD; Christopher Dentch, PhD; Brian Robben, MPH; Elise K. Gersh, MPH; Sunny Kutaga, PharmD, MS; Julie Lind, PhD; Jennifer Lee, MD, PhD; Jennifer Lee, MD, PhD; Jason Vesny, MD; and Deepak Voora, MD

MVP MILLION VETERAN PROGRAM

***CYP2C19* polymorphisms and clinical outcomes following percutaneous coronary intervention (PCI) in the Million Veterans Program**

Caroline Chantreau, Julie A. Lynch, Ben Judson, Mary E. Romanides, Scott L. D'Amico, Kevin Fricker, Daniel J. Baker, Scott Damania, Ryan M. Chang, Jay Chao, Soledad Balboa, Robert M. Berry, Jr, David G. DeGuzak, Deepak Voora, Jason Vesny, Stephen Williams, Chae O'Donnell, and Paul Topol

Summary

- PHASER will be one of the largest implementations of pre-emptive PGx testing in clinical care in the US
- Integration of PGx testing across multiple, disparate health systems presents an opportunity to learn how to implement precision medicine at scale.
- In a learning health system approach, data mining will allow us to optimize implementation and adapt to new barriers/opportunities.



THANKS!
deepak.voora@va.gov

*We are always looking for bright, motivated collaborators, post-doctoral fellows,
and scientists excited to partner with PHASER*