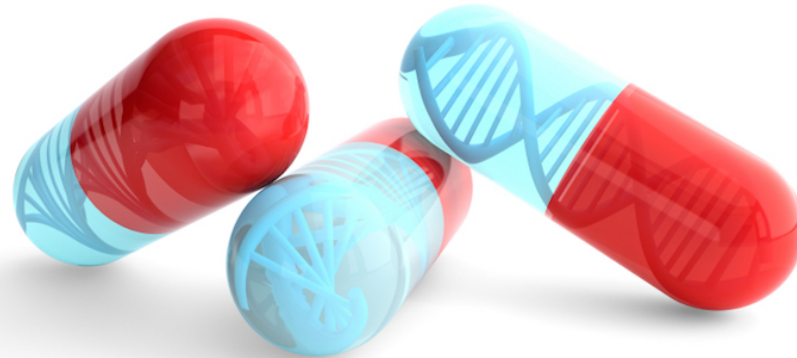


Informatics and Pharmacogenomics



Hamed Abbaszadegan, MD, MBA, FACP, FAMIA

Chief Health Innovation & Informatics Officer

Phoenix VA Health Care System

Clinical Associate Professor of Biomedical Informatics, Internal Medicine, & Pathology

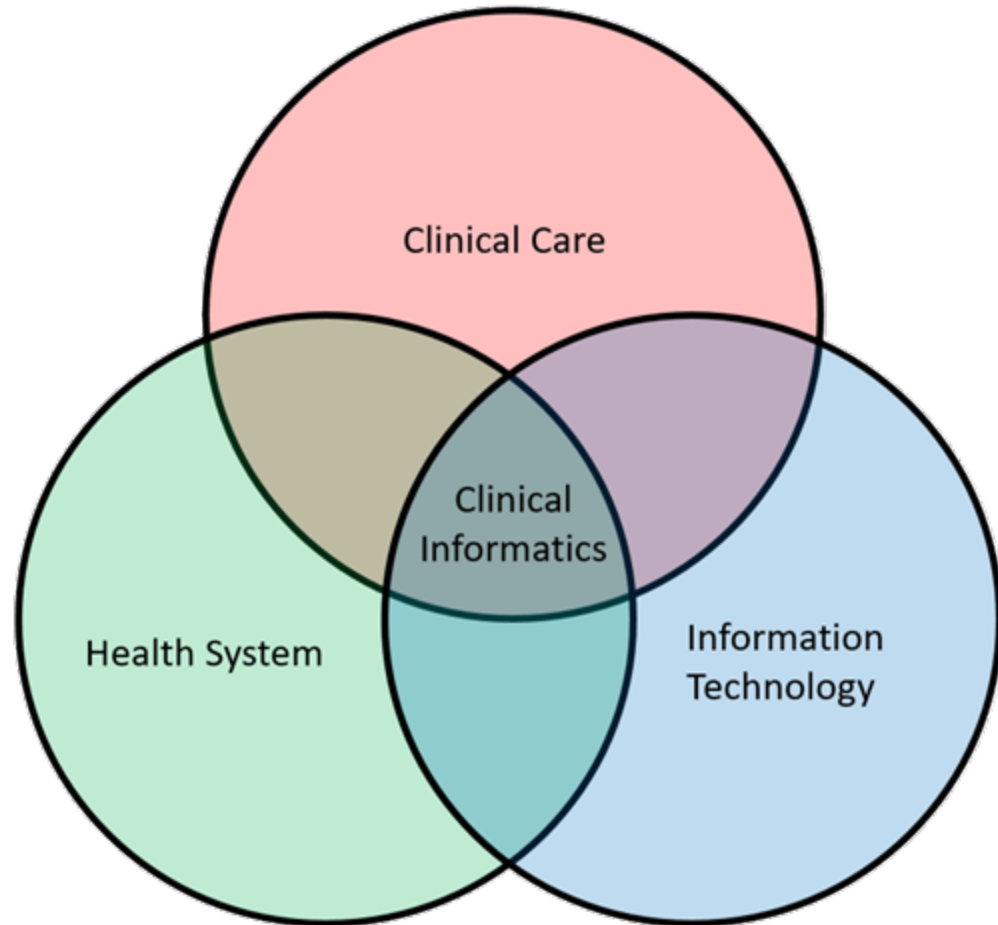
University of Arizona College of Medicine-Phoenix

Learning Objectives

- Formulate structural documentation
- Describe the decision support infrastructure
- Identify intelligent approaches to patients for PGx testing



Clinical Informatics in Healthcare

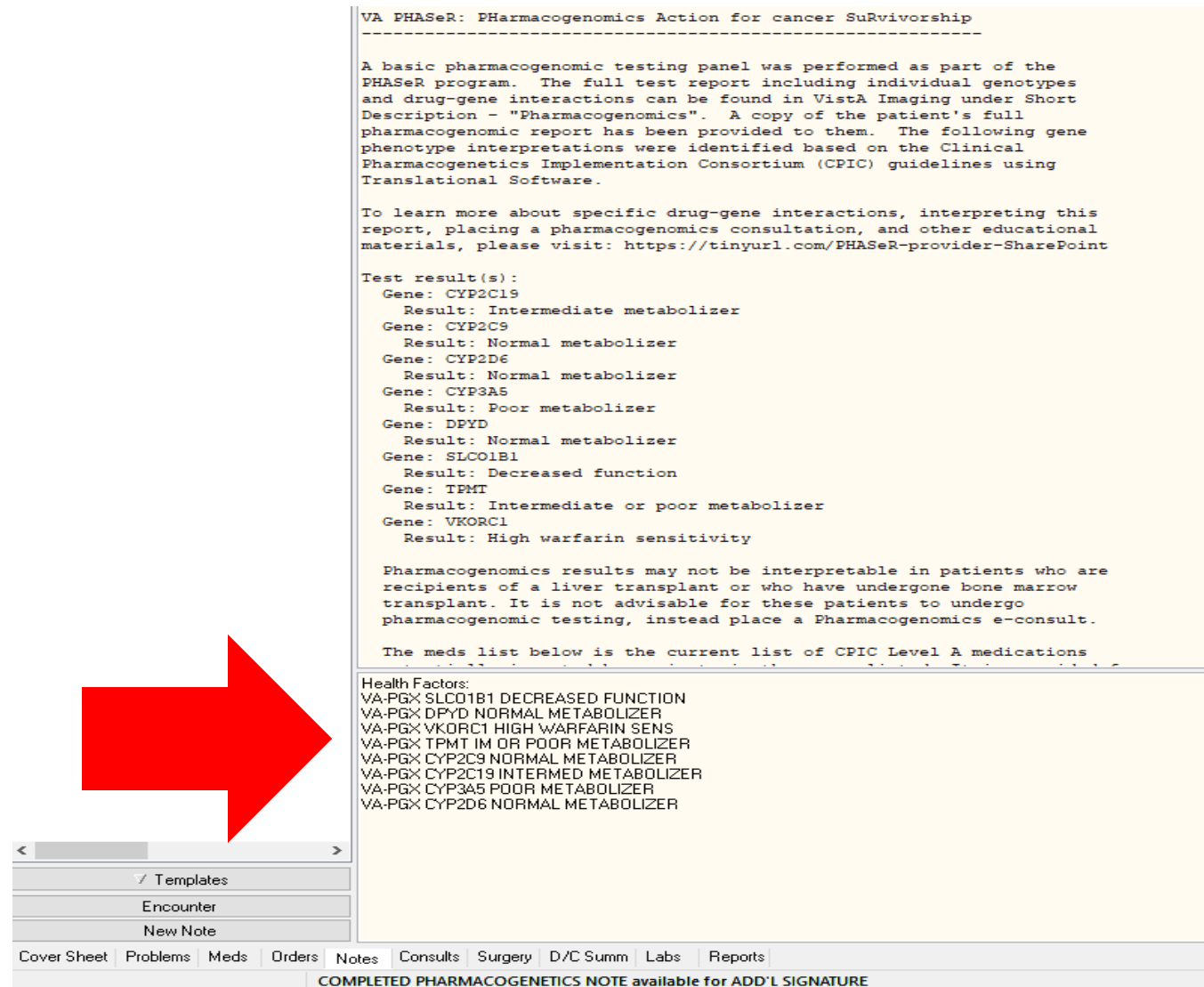


Structural Documentation

- Formalizes charting
- Allows for standardization
- Creates “back-end” data warehouse storage → Mining
- Most important, allows for Decision Support functionality



Structural Documentation in Action



VA PHASeR: PHarmacogenomics Action for cancer SuRvivorship

A basic pharmacogenomic testing panel was performed as part of the PHASeR program. The full test report including individual genotypes and drug-gene interactions can be found in VistA Imaging under Short Description - "Pharmacogenomics". A copy of the patient's full pharmacogenomic report has been provided to them. The following gene phenotype interpretations were identified based on the Clinical Pharmacogenetics Implementation Consortium (CPIC) guidelines using Translational Software.

To learn more about specific drug-gene interactions, interpreting this report, placing a pharmacogenomics consultation, and other educational materials, please visit: <https://tinyurl.com/PHASeR-provider-SharePoint>

Test result(s):

- Gene: CYP2C19
Result: Intermediate metabolizer
- Gene: CYP2C9
Result: Normal metabolizer
- Gene: CYP2D6
Result: Normal metabolizer
- Gene: CYP3A5
Result: Poor metabolizer
- Gene: DPYD
Result: Normal metabolizer
- Gene: SLCO1B1
Result: Decreased function
- Gene: TPMT
Result: Intermediate or poor metabolizer
- Gene: VKORC1
Result: High warfarin sensitivity

Pharmacogenomics results may not be interpretable in patients who are recipients of a liver transplant or who have undergone bone marrow transplant. It is not advisable for these patients to undergo pharmacogenomic testing, instead place a Pharmacogenomics e-consult.

The meds list below is the current list of CPIC Level A medications

Health Factors:
VA-PGX SLCO1B1 DECREASED FUNCTION
VA-PGX DPYD NORMAL METABOLIZER
VA-PGX VKORC1 HIGH WARFARIN SENS
VA-PGX TPMT IM OR POOR METABOLIZER
VA-PGX CYP2C9 NORMAL METABOLIZER
VA-PGX CYP2C19 INTERMED METABOLIZER
VA-PGX CYP3A5 POOR METABOLIZER
VA-PGX CYP2D6 NORMAL METABOLIZER

Navigation: < / Templates Encounter New Note >

Navigation: Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports

COMPLETED PHARMACOGENETICS NOTE available for ADD'L SIGNATURE

Structured Consent

Reminder Dialog Template: PHARMACOGENETICS NOTE

VA PHASeR: PHarmacogenomics Action for cancer SuRvivorship

Consent and ordering

I have discussed the availability of PHASeR pharmacogenomic testing panel with this patient and explained its risks, benefits, and limitations. I have given the patient an opportunity to ask questions regarding pharmacogenomic testing and I have satisfactorily addressed them.

The patient agrees to have the PHASeR pharmacogenomic test panel performed; ordered now via this selection (order will display after template is finished).

The patient does not agree to have the PHASeR pharmacogenomic test panel performed and does not want to be contacted about testing in the future.

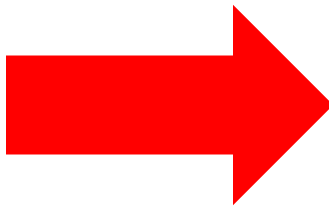
The patient does not want to undergo testing now but agrees to low PHASeR staff to contact him/her at a later date to discuss testing further.

Visit Info

VA PHASeR: PHarmacogenomics Action for cancer SuRvivorship

I have discussed the availability of PHASeR pharmacogenomic testing panel with this patient and explained its risks, benefits, and limitations. I have given the patient an opportunity to ask questions regarding pharmacogenomic testing and I have satisfactorily addressed them.
The patient agrees to have the PHASeR pharmacogenomic test panel performed.

Health Factors: VA-PGX PROVIDER EDUCATION (Historical), VA-PGX TESTING ACCEPTED (Historical)
Orders: PHARMACOGENETICS PANEL (Historical)



Standardized Note

Vista CPRS in use by: (vista.phoenix.med.va.gov)

File Edit View Action Options Tools Help

PGXMDVC Dec 26.19 10:15 No PACT assigned at any VA location / JLV Postings CWAD

Reminder Dialog Template: PHARMACOGENETICS INTERPRETATION NOTE

PHARMACOGENETICS INTERPRETATION NOTE

Current outpatient medications reviewed with patient. Potentially impacted medications along with drug dosing guidance reviewed with patient.

Active Outpatient Medications (excluding Supplies):

Active Outpatient Medications	Status
1) METOPROLOL SUCCINATE 100MG SA TAB TAKE ONE TABLET EVERY DAY	HOLD

Active Non-VA Medications

Active Non-VA Medications	Status
1) Non-VA ACETAMINOPHEN 500MG TAB 500MG BY MOUTH	ACTIVE
2) Non-VA AMLODIPINE BESYLATE 10MG TAB 5MG BY MOUTH EVERY DAY	ACTIVE
3) Non-VA ASPIRIN 81MG EC TAB 81MG BY MOUTH EVERY DAY	ACTIVE
4) Non-VA ATENOLOL 25MG TAB 25MG BY MOUTH EVERY DAY	ACTIVE
5) Non-VA ATENOLOL 50MG TAB 50MG BY MOUTH EVERY DAY	ACTIVE
6) Non-VA BARRIER, SENSURA COLOPLAST #10512 BARRIER AS DIRECTED	ACTIVE
7) Non-VA HYDROCHLOROTHIAZIDE 25MG TAB 25MG BY MOUTH EVERY MORNING	ACTIVE
8) Non-VA LISINAPRIL 20MG TAB 20MG BY MOUTH EVERY MORNING	ACTIVE
9) Non-VA MEDICAL MARIJUANA MISCELLANEOUS AS DIRECTED	ACTIVE
10) Non-VA METOPROLOL SUCCINATE 50MG SA TAB 50MG BY MOUTH EVERY DAY	ACTIVE
11) Non-VA PROZAC 20MG CAP 20MG BY MOUTH EVERY DAY	ACTIVE
12) Non-VA RISPERIDONE 0.5MG TAB 0.25MG BY MOUTH	ACTIVE
13) Non-VA SERTRALINE HCL 25MG TAB 25MG BY MOUTH EVERY DAY	ACTIVE
14) Non-VA SIMVASTATIN 40MG TAB 20MG BY MOUTH AT BEDTIME	ACTIVE

Visit Info Finish Cancel

Current outpatient medications reviewed with patient. Potentially impacted medications along with drug dosing guidance reviewed with patient.

<No encounter information entered>

* Indicates a Required Field

Encounter New Note

Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports

Assessment/Plan

Vista CPRS in use by: (vista.phoenix.med.va.gov)

File Edit View Action Options Tools Help

ZZZTESTPATIENT.ALPHA (OUTPATIENT) Visit Not Selected No PACT assigned at any VA location /
000-00-1231 Jan 01,1970 (49) Provider: AL.YAQ00BI,ALI

PHARMACOGENETICS INTERPRETATION NOTE

UNSIG/UNCOS'D PHARMACOGENETICS INTERPRETATION NOTE available
Note being edited
Dec 26,2019 PHARMACOGENETICS INTERPRETATION NOTE , PHX-PGK

Vst 12/26/19 PHX-PGX PHYS VVC Dec 26,2019@10:18

12) Non-VA RISPERIDONE 0.25MG TAB 0.25MG BY MOUTH ACTIVE
13) Non-VA SERTRALINE HCL 25MG TAB 25MG BY MOUTH EVERY DAY ACTIVE
14) Non-VA SIMVASTATIN 40MG TAB 20MG BY MOUTH AT BEDTIME ACTIVE

15 Total Medications

ASSESSMENT:

Pharmacogenetics Result Interpretation with Recommendations: reviewed pharmacogenetics results along with current and immediately planned medications with patient.

Based on the available genes tested, patient is not currently on any medications that would require action.

PLAN:

No active actionable recommendation at this time.

Future medication risks are based on the actionable recommendations below.

Actionable Recommendations:

Disclaimer
Future re-testing recommended if new genes are available for testing. This report is based on the most recent pharmacogenetic testing for this patient. Over time changes in pharmacogenetic reporting and interpretation may occur. In addition, many of these genes will no longer be relevant if this patient has a liver transplant.

Templates

- NEW PC APPOINTMENT CONTACT
- Non VA routine consult
- NON VA RX V2
- Nursing Test Folder
- NUTRITION RISK SCREEN
- Nutrition Test Folder
- ONCOLOGY PSYCHOSOCIAL DISTRESS SCREENING
- OPIOID
- Opioid Discontinuation Note
- Out-Of-OR Procedures
- PACT POST DC
- PAIN
- PALLIATIVE CARE NATIONAL CLINICAL TEMPLATE
- Personal Templates Transfer Folder
- PHARM NFDR REVIEW
- Pharmacogenomics
 - PHARMACOGENETICS INTERPRETATION NOTE
 - PHARMACOGENOMICS ACTION FOR CANCER SURVIVORS
 - PHD CLC NURSING ADMISSION ASSESSMENT
 - PHD CLC NURSING ADMISSION NOTE (2019)
 - PHD CLC NURSING ADMISSION NOTE (2019)
 - PHD NURSING DISCHARGE EDUCATION
 - PHOENIX-VA-WH MAMMOGRAM REVIEW RESULTS
 - PICC NOTE
 - PICC NOTE
 - pl activeXXXX
- PM&R
- PODIATRY CLINIC NOTE
- Population Health

Reminders

Encounter

New Note

Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports

Encounter

VistA CPRS in use by: Al Yaqoobi, Ali (vista.phoenix.med.va.gov)

File Edit View Action Options Tools Help

ZZZTESTPATIENT ALPHA (OUTPATIENT) PGXMDVC Jan 06, 20 17:03 No PACT assigned at any VA location /

000-00-1231 Jan 01, 1970 (50) Provider: AL YAQOOBI, ALI

Flag JLW Remote Data Postings CWAD

Last 100 Signed Notes (Total: 684)

New Note in Progress

Jan 06, 20 PHARMACOGENETICS INTERPRETATION NOTE , PH

All signed notes

- Administrative Note
- Advance Directive
- Adverse React/Allergy
- Anesthesia Flow Sheet
- Blood Transfusion Consent

PHARMACOGENETICS INTERPRETATION NOTE

Vst: 01/06/20 PHX-PGX PHYS VVC Jan 06, 2020@17:03

Expected Cosigner: Abbaszadegan, Hamed

1.6 Total Medications

Encounter Form for PHX-PGX PHYS VVC (Jan 06, 2020@17:03)

Visit Type Diagnoses Procedures Vitals Immunizations Skin Tests Patient Ed Health Factors Exams

Procedure Section NEW PATIENT

NEW PATIENT

- MTMS BY PHARM, INIT 15 MIN
- MTMS BY PHARM, EA-ADDL 15 MIN

Modifiers for Medical Genetics and Genetic Counseling

- State With Firm Agency Funding RW
- State Supplied Vaccine SL
- State/Fed Funded Program/Ser SE
- Statutorily Excluded GY
- Subsequent Claim EJ
- Substance Abuse Program HF
- Svc Exempt - Ordig/Firing Md Q4
- Svc On Behalf Client-Collat UK
- Svc Part Of Family Plan Pgm FP
- Synchronous Telemedicine Service SS
- Technical Component TC
- Telectroke GO
- Third Opinion SN
- Three Patients Served UP
- Two Class B Findings Q8
- Two Patients Served UN
- Unrelated F/M Service By Same Physician D

Other Procedure...

Quantity Selected Procedures

Medical Genetics an...

Comments

Provider: Quantity 1 Select All Remove Cancel

Templates

- NON VA RX V2
- Nursing Test Folder
- NUTRITION RISK SCREEN
- Nutrition Test Folder
- ONCOLOGY PSYCHOSOCIAL DISTRESS SCREENING
- OPioid
- Opioid Discontinuation Note
- Out-Of-OR Procedures
- PACT POST DC
- PACT POST HOSPITAL FOLLOW-UP NOTE / PRIMARY CARE
- PACT POST-EMERGENCY DEPARTMENT FOLLOW-UP NOTE
- PAIN
- PALLIATIVE CARE NATIONAL CLINICAL TEMPLATE
- Personal Templates Transfer Folder
- PHARM NFDR REVIEW
- Pharmacogenomics
 - PHARMACOGENETICS INTERPRETATION NOTE
 - PHARMACOGENOMICS ACTION FOR CANCER SURVIVORS
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- PHO CLC NURSING ADMISSION NOTE (2019)
- PHO CLC NURSING ADMISSION NOTE (2019)
- PHO NURSING DISCHARGE EDUCATION
- PHOENIX-VA-WH MAMMOGRAM REVIEW RESULTS
- PICC NOTE
- PICC NOTE
- pl active XXXX
- PM&R
- PODIATRY CLINIC NOTE
- Population Health

Reminders

Encounter

New Note

Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports

Ultimate Goal → Function of Results

Drug Dosing Guidance



A medication has potentially reduced efficacy, increased toxicity or the patient has an increased risk for the indicated condition.



Guidelines exist for adjusting dosage, increased vigilance or the patient has a moderate risk for the indicated condition.

ACTIONABLE

Recommendations based upon publications by international pharmacogenetic expert groups, consortia or regulatory bodies. Recommendations are suitable for implementation in a clinical setting. Guidelines may change as knowledge arises.



Clopidogrel
Plavix®

Reduced Response to Clopidogrel (CYP2C19: Intermediate Metabolizer)

ACTIONABLE

Consider alternative therapy. Examples of alternative drugs: prasugrel (contraindicated in TIA/Stroke patients), ticagrelor, aspirin, aspirin plus dipyridamole.



Atomoxetine
Strattera®

Possible Atomoxetine Underexposure Leading to Decreased Response (CYP2D6: Normal Metabolizer)

ACTIONABLE

The genotype result indicates that the patient is likely to have an insufficient response due to inadequate drug exposure following standard dosing. Consider the following dosing strategy:

- Initiate treatment at 40 mg/day, increase to 80 mg/day after 3 days and maintain dose.
- If after 2 weeks, optimal clinical response is not observed and adverse events are not present, consider a dose increase to 100 mg/day.
- If after 2 weeks, optimal clinical response is not observed and adverse events are not present, consider therapeutic drug monitoring 1-2 hours post dose. If the plasma concentration is less than 200 ng/ml consider a

Decision Support Infrastructure

- Clinical Reminder Order Checks (CROC)
- Logic:
 - Citalopram:
 - IF the patient is to receive Citalopram AND has genotype results for CYP2C19 AND CYP2D6 available, THEN query phenotypes.
 - IF phenotype is CYP2C19 ultra-rapid phenotype AND CYP2D6 normal or intermediate phenotype THEN CROC will fire when citalopram is ordered.

Order Checks

Select Reminder Order Check Menu Option: GE Add/Edit Reminder Order Check Items Group

Select Reminder Order Check Items Group by one of the following:

N: ORDER CHECK ITEMS GROUP NAME
C: VA DRUG CLASS
D: DRUG
G: VA GENERIC
O: ORDERABLE ITEM
R: ORDER CHECK RULE
Q: QUIT

Select Reminder Order Check Items Group by: (N/C/D/G/O/R/Q): N//

Order Check Details

Rule Name: VA-LONG QT SYNDROME (RULE)
Display Name: ISSUE: Patient with documented long QT syndrome
Class: National
Sponsor:
Review Date:
Status: Production
Severity: High

Reminder Term: VA-LONG QT SYNDROME (TERM) Reminder Term Status: TRUE
Order Check Text:

* The selected medication is known to also

REMINDER ORDER CHECK ITEMS GROUP INQUIRY Jan 10, 2020 2:24:59 pm Page 19

prolong the QT interval

RECOMMENDATIONS:

- Avoid use if at all possible
- If prescribed, provide close medical observation for arrhythmias

Rules

Rule Description:

Clinical Reminder Order Check (CROC) designed in response to NSR #20110211 to warn when ordering a medication known to prolong QT interval for a patient with documented Long QT Syndrome. ---R. Silverman [PBM] Jan 2018, Jun 2018

Interface of Order Check

Antipsychotic Long-Acting Injections

Please ensure injection is ordered underneath your standard clinic location

Atypical Antipsychotic Long-Acting Injectables:

- >> Aripiprazole long-acting injection
- >> Paliperidone long-acting injection
- >> Risperidone long-acting injection

Typical Antipsychotic Long-Acting Injectables:

- >> Fluphenazine long-acting injection
- >> [Haloperidol long-acting injection](#)

Clinic Medications

HALOPERIDOL (LONG-ACTING) DECANOATE INJ

Do Not Give IV**IM use only via Gluteal muscle

Dosage / Rate	Complex	Tier	Route	Schedule (Day-Of-Week)	PRN
50MG/1ML		\$19.520	INTRAMUSCULAR	Q4WKS	<input type="checkbox"/>
25MG/0.5ML		\$9.760	INTRAMUSCULAR	Q18H	
50MG/1ML		\$19.520	INTRAMUSCULAR	Q1H	
100MG/1ML		\$35.790		Q20MIN PRN	
				Q24H	
				Q24HIV	
				Q2H	
				Q2WK	
				Q30M	
				Q30MIN PRN	
				Q36H	
				Q3H	
				Q3WK	
				Q48H	
				Q48HIV	
				Q4H	
				Q4HIV	
				Q4HR	
				Q4HR-ALT1	
				Q4HR-ALT2	
				Q4WKS	
				Q5 MIN PRN	
				Q5H PRN	
				Q6H	
				Q6H-ALT1	
				Q6H-ALT2	
				Q6HIV	
				Q6HR	
				Q6H-TUBE FEED	
				Q720H	
				Q72H	
				Q8H	

Order Checking

(1 of 1) ISSUE: Patient with documented long QT syndrome

* The selected medication is known to also prolong the QT interval.

RECOMMENDATIONS:

- Avoid use if at all possible
- If prescribed, provide close medical observation for arrhythmias

Buttons: Accept Order, Cancel Order, Drug Interaction Monograph

HALOPERIDOL (LONG-ACTING) DECANOATE INJ

50MG/1ML IM Q4WKS TEST

Buttons: Accept Order, Quit

Informatics Intelligence

Potentially Impacted Medications

CATEGORY	DRUG CLASS	STANDARD PRECAUTIONS	USE WITH CAUTION	CONSIDER ALTERNATIVES
Anticancer Agents	Fluoropyrimidines	Capecitabine (Xeloda®) Fluorouracil (Acrucil® (iv); Carac® (topical); Efudex® (topical))		
	Thiopurines	Azathioprine (Azasan®, Imuran®) Mercaptopurine (Purinethol®, Purixan®)		
Cardiovascular	Anticoagulants		Warfarin (Coumadin®)	
	Antiplatelets			Clopidogrel (Plavix®)
	Statins			Simvastatin (Zocor®)
Gastrointestinal	Antiemetics	Ondansetron (Zofran®, Zuplenz®)		
Infections	Antifungals			Voriconazole (Vfend®)
Pain	Opioids	Codeine (Codeine; Fioricet® with Codeine) Tramadol (Ultram®)		
Psychotropic	Anti-ADHD Agents		Atomoxetine (Strattera®)	
	Antidepressants	Desipramine (Norpramin®) Fluoxetine (Prozac®, Sarafem®) Fluvoxamine (Luvox®) Nortriptyline (Pamelor®) Paroxetine (Paxil®, Brisdelle®)	Citalopram (Celexa®) Escitalopram (Lexapro®) Sertraline (Zoloft®)	Amitriptyline (Elavil®) Clomipramine (Anafranil®) Doxepin (Silenor®) Imipramine (Tofranil®) Trimipramine (Surmontil®)
Transplantation	Immunosuppressants	Tacrolimus (Prograf®)		

Telehealth Instant Connection

The screenshot shows a web browser window at care.va.gov/vvc-app/#/. The interface is for a "Video Connect" session. On the left, a sidebar lists participants: "AL YAQOobi,ALI" (Host) and "ABBASZADEGAN,..." (Guest). Below this is a "Chat room" section with a message icon and the text: "There are no chat messages yet. Write a message below to start chatting." At the bottom of the sidebar is a "Write a message" input field. The main video area shows a doctor in a checkered shirt and stethoscope. A small inset window displays a medication list titled "Prescribed Inpatient Medication" with columns for medication name, dose, and frequency. A "Presenter: AL YAQO..." label is visible over the medication list. In the top right corner of the video area, there is a small video thumbnail of the doctor. At the bottom of the video area, a notification bar states "care.va.gov is sharing your screen." with "Stop sharing" and "Hide" buttons.

Review Results

care.va.gov/vvc-app/#/

VA Bookmarks New Tab Search Federal Emp... vatas - Google Sear... https://www.marrio... Location

Video Connect

AL YAQOOBI,ALI
Host

ABBASZADEGAN,...
Guest

Chat room

There are no chat messages yet. Write a message below to start chatting.

Write a message

AL YAQOOBI,ALI

A9624.pdf - Adobe Acrobat Reader DC

File Edit View Window Help

Home Tools TCA_2016.pdf A9624.pdf x

Protected View: This file originated from a potentially unsafe location, and most features have been disabled to avoid potential security risks. [Enable All Features](#)

Potentially Impacted Medications

CATEGORY	DRUG CLASS	STANDARD PRECAUTIONS	USE WITH CAUTION	CONSIDER ALTERNATIVES
Anticancer Agents	Fluoropyrimidines	Capecitabine (Xeloda®) Fluorouracil (Adrucil® (iv); Carac® (topical); Efude® (topical))		
	Thiopurines		Azathioprine (Azasan®, Imuran®) Mercaptopurine (Purinethol®, Purixan®)	
	Anticoagulants	Warfarin (Coumadin®)		
Cardiovascular	Antiplatelets	Clopidogrel (Plavix®)		
	Statins	Simvastatin (Zocor®)		
Gastrointestinal	Antiemetics	Ondansetron (Zofran®, Zuplenz®)		
Infections	Antifungals	Voriconazole (Vfend®)		
Pain	Opioids	Codeine (Codeine; Fioricet® with Codeine) Tramadol (Ultram®)		
	Anti-ADHD Agents		Atomoxetine (Strattera®)	
Psychotropics		Amitriptyline (Elavil®) Citalopram (Celexa®) Clomipramine (Anafranil®) Desipramine (Norpramin®) Doxepin (Silenor®) Escitalopram (Lexapro®)		

Presentation Quality: Normal

1/10/2020

Let's Collaborate!

- Lets collaborate!

Hamed.Abbaszadegan@va.gov

