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## Pharmacogenomics: A pre-emptive tool for effective medication management

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DNA-based prescribing and genomic decision support is resulting in a fundamentally different type of clinical decision making. Aided by pharmacogenomic (PGx) testing to determine how an individual will respond to medications based on their DNA, physicians can immediately evaluate which drugs may be ineffective for a given patient, avoiding adverse reactions, reducing variability of treatment outcomes, and improving resource utilization and costs.

Clinical evidence continues to mount that genetic variations impact patient response to medications. Patients with specific genotypes are at increased risk from taking many widely prescribed drugs, such as common pain and cardiovascular medications. In a large-scale analysis of the medication lists of 505,000 patients undertaken to assess drug-gene interactions across four important genes, results showed that 20 percent had a PGx profile associated with a severe drug-gene interaction to drugs on their current medication list. An additional 48 percent of patients had a PGx profile that showed a moderate drug-gene interaction.

The most commonly-prescribed drugs in the patient population interacting with these four genes included atorvastatin, clopidogrel, hydrocodone, metoprolol, oxycodone, omeprazole, simvastatin, and tramadol. The majority of patients (75 percent) were taking at least one medication for which genotype-based prescribing is available.

Evidence-based PGx guidance is now available for more than 20 genes and over 200 medications to help treat several medical conditions including cancer, cardiovascular disease, mental health illnesses, and pain.

These results suggest that clinical guidelines that do not incorporate genetic variability fail many patients who may experience more successful, evidence-based treatment through use of PGx testing. Let's review the major ways physicians and their patients may benefit most from PGx testing.

### **Improved healthcare utilization and costs**

Many patients who experience trial-and-error prescribing, particularly elderly patients on five or more medications, have a greater probability of higher resource utilization and healthcare costs. When treatment plans fail due to suboptimal medications, it can result in a significant increase in provider visits, costly prescription changes, hospitalizations, medical absence days, disability claims, and a reduced quality of life for the patient.

By pre-emptively identifying responders and non-responders to medications, and optimizing drug doses, PGx testing has significant potential to reduce inappropriate medication use and expense, decrease healthcare utilization such as unnecessary hospitalizations and emergency department visits, and improve patient satisfaction and medication adherence.

One area where PGx testing is showing significant promise is in treating psychiatric and mental health disease. An [IMPACT study in the Journal of Psychiatric Research](#), the largest pharmacogenomics clinical study on depression, showed that patients with treatment-resistant major depressive disorder were 30 percent more likely to respond to treatment and 50 percent more likely to achieve remission when their medication selection was guided by PGx testing.

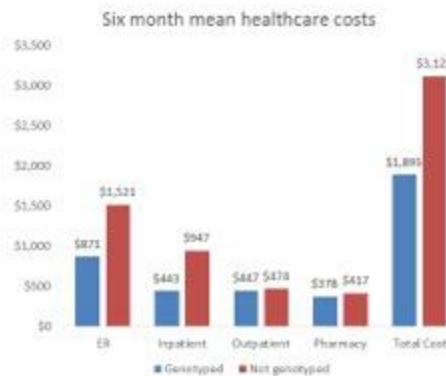
Another [study](#) among patients with mood and anxiety disorders demonstrated that PGx testing is associated with decreased resource utilization and cost. Insights from a PGx test for psychotropic medications were analyzed across six months for cost of care and resource utilization.

Using data from a large commercial health plan, individuals with a mood or anxiety disorder diagnosis (N = 817) who received genetic testing were matched to 2,745 individuals who did not receive testing. Outcomes included number of outpatient visits, inpatient hospitalizations, ED visits and prescriptions, and associated costs over six months.

The results showed that on average, individuals who underwent PGx testing experienced 40 percent fewer all-cause ED visits and 58 percent fewer inpatient all-cause hospitalizations than individuals in the control group. Overall six-month costs were estimated to be \$1,948 lower in the tested group.

## Psychiatric PGx claims data

- Mood/anxiety disorder patients receiving PGx testing (n = 817) compared to propensity-matched controls (n = 2,745)
- Over 6 months, PGx-tested patients experienced:
  - 40% fewer all-cause ER visits (p < 0.0001)
  - 58% fewer all-cause hospitalizations
  - \$1,228 reduction in total costs compared to TAU (\$2,456 annualized)



Pertis Ari, et al. Pharmacogenetic testing among patients with mood and anxiety disorders is associated with decreased utilization and cost: a propensity score matched study. *Depress Anxiety*. 2018;17.

### Reduced adverse drug events – especially in the elderly

According to the [Centers for Disease Control and Prevention](#), adverse drug events cause more than 1.3 million emergency department visits and 350,000 hospitalizations each year. **The CDC estimates that \$3.5 billion is spent annually on excess medical costs to treat ADEs.**

The value of PGx testing is greatest in adults and the elderly who have the highest clinical risk for experiencing an adverse event. Older individuals are particularly at risk for adverse drug events due to polypharmacy, co-morbidities, and a host of age-related variables that alter drug response. **Among older adults, anticoagulants, diabetes medicines, and opioid painkillers are implicated in nearly 60 percent of emergency department visits for ADEs.**

**A significant percentage of ADEs could likely be avoided if patients in high-risk categories were routinely prescribed medications based on their PGx profile.** Hopefully we will soon see PGx testing as a routine standard of care in specific areas where the risk has found to be most significant, such as clopidogrel testing for all patients undergoing catheterizations, and pre-surgical screening for both warfarin and pain medications.

### Improved patient satisfaction and competitive advantage

Understanding a patient's genetic makeup prior to prescribing certain medications gives physicians a genetic-based tool that can be used along with patient history and other lifestyle factors to personalize patient treatments for life. The results of a single PGx test may be used for many diagnostic purposes, across many treatment episodes in a patient's lifetime.

**With evidence-based PGx testing results, physicians can speak with more certainty regarding a patient's treatment plan, leading to increased patient confidence and satisfaction with their prescribed medication regime.** [Research funded by the U.S. National Institutes of Health](#) also suggests a positive correlation between PGx testing and improved medication adherence.

Learning the genetic likelihood of a good therapeutic response to a medication helps increase perceived need for and trust in the medication, contributing to better adherence.

Finally, consumers are increasingly aware that retail access to medication testing is available, and some employers are already beginning to offer genetic testing as part of their voluntary benefits package. With a great deal of focus on DNA-based diagnostics, a growing percentage of patients want to know their susceptibility to disease and how they will respond to their medications. Consumers will expect their healthcare providers to use genomic information to support precision medicine initiatives. Progressive clinical organizations and providers will want to harness this growing demand by offering relevant genomic testing capabilities as a way to attract new patients and competitively differentiate their services.