Precision Psychiatry: How Data-Driven Solutions Are Transforming Medication Management

Genotype-guided prescribing, fueled by powerful advances in data science, is gaining traction in psychiatry by offering personalized treatment approaches based on individual genetic variations. This approach has been associated with positive clinical outcomes, such as improved response and remission rates. Additionally, the implementation of genotype-guided algorithms has shown promise in optimizing drug selection and dosing. Studies have specifically highlighted the importance of integrating genomic result reports into electronic medical records, standardizing decision support systems, and training programs. Pharmacogenomic testing, when combined with an excellent clinical history, has significant potential in the treatment of psychiatric disorders.

The growing support for this approach could not be more timely: the U.S. Department of Health and Human Services and numerous other government centers, foundations and healthcare systems are warning of dramatic increases in mental health needs, even as financial and access barriers to care persist. **While these tests are not intended to be standalone algorithms to choose medications, pharmacogenetic testing in psychiatry has significant potential for helping to manage patient care more efficiently while improving treatment outcomes and clinical workflows.**

TODAY'S MENTAL HEALTH CRISIS

Psychiatry is facing a crisis – delivering effective and timely care to those in need, including healthcare workers themselves, and responding to increased, continued requests for care since the COVID-19 pandemic.[1,2]

22% of U.S. adults were diagnosed with a mental illness in the past year[3]

The increased demand for mental health services has outpaced the provision of care, leaving millions of Americans with unmet medical needs.[4]
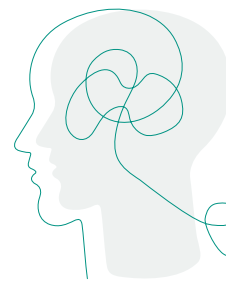
Almost **40%** of adults with a major depressive episode in the past year were **untreated**[3]

Increasing depression severity or number of depressive episodes, which may reflect ineffective treatment for depression, are linked with incidents or worsening comorbid conditions.[5] Poorly treated mental illnesses also come with great social and economic burdens.[4]

Multifaceted needs in psychiatric treatment include targeted interventions, improved collaboration among healthcare providers, and enhanced support systems to overcome current challenges and deliver effective mental health care. Psychiatrists may benefit from adding tools that enable more efficient care delivery in the face of growing patient demand.

KEY POINTS

- The increased demand for mental health services has outpaced the provision of care
- The conventional practice of psychiatric medication trial and error frequently leads to suboptimal patient outcomes
- To be more efficient in care delivery with the growing demand of patient volume, psychiatrists can utilize the tool of genotype-guided prescribing
- Genotype-guided prescribing has demonstrated improved response and remission rates in studies
- Dynamic software platforms can integrate complex analytic capabilities with an automated data-to-insight approach, significantly reducing the need for manual clinician interpretation of individual patient profiles

THE TREATMENT STATUS QUO – LOW EFFICACY AND TOLERABILITY

Psychiatrists regularly feel the challenges related to psychotropic medication prescribing. Conventional trial-and-error prescribing in psychiatry, based on informed decision-making and patient preferences, can ultimately determine the most effective and tolerable treatment. However, the complexity of mental health conditions and the variability in individual responses to medications necessitates ongoing monitoring and adjustment of treatment regimens, which can delay effective treatment and affect patient outcomes and quality of life.

The interindividual variation in patient responses to commonly used psychotropic drugs is, in part, caused by the biological heterogeneity of psychiatric disorders, including major depressive disorder. This suggests that identifying biomarkers that predict the response to psychotropic drugs is a useful way to reduce some of the uncertainty associated with the disease heterogeneity.[12,20]

Up to
2/3 of patients
report inadequate symptom control on their first antidepressant.[6]

Dose escalations or additional medication trials often yield minimal to modest treatment benefits and, more often, result in increased burden of side effects. Faced with medication failures, clinicians often resort to (or continue) polypharmacy, which is linked to still greater health risks.[8] High rates of early treatment discontinuation significantly hinder successful management of major depressive disorder and are likely tied to poor efficacy, safety, and tolerability of psychiatric medications.

- Adherence to psychotropics is just 40-50%, approximately, within three months.[8]
- The high prevalence of adverse drug reactions (ADRs) is a primary factor driving treatment discontinuation.[8] **In a study from an outpatient psychiatric clinic, 22% of patients taking an antidepressant reported an ADR.[9]**
- Adverse drug reactions can contribute to patient morbidity and mortality, underscoring the need for pharmacovigilance practices in psychiatry. Antidepressants are associated with a notable proportion of the preventable drug-related hospital admissions.[10]

The conventional practice of psychiatric medication trial and error frequently leads to suboptimal patient outcomes, including prolonged time to remission, extended periods of disability, diminished quality of life – and, most critically, an ongoing elevated risk of suicide. A paradigm shift towards personalized, patient-centered treatment options is imperative to improving patient outcomes and transforming the global public health challenge in mental healthcare.

THE SOLUTION: GENOTYPE-GUIDED TESTING AND PRECISION MEDICINE

The current mental health crisis, exacerbated by a shortage of primary and mental health clinicians and the challenges posed by ADRs, requires a critical reassessment of the conventional methods and decision support tools available for use in psychiatric medication management.

Emerging technologies, such as genotype-guided testing and advanced medication data analytics, herald a new era in mental health treatment: precision medicine. Genotype-guided testing is the study of genetic variability in drug absorption, distribution, metabolism, excretion, and receptor targeting.[11] This emerging field gives physicians a highly precise understanding of a patient's inherited ability to respond to a drug, which can guide more personalized medication choices and tailored treatments.[12] By leveraging these cutting-edge technologies, clinicians can make more informed decisions, potentially reducing the trial and error associated with conventional treatment methods.

More than 80% of psychiatrists surveyed acknowledged that genotype-guided testing would be beneficial for identifying the most appropriate treatments, and more than 70% considered the tests useful for predicting tolerability issues.[13,14]

Genetic variations can predict who will have improved outcomes or adverse effects with specific medications. By uncovering this critical information in a timely manner, ideally before writing a prescription, physicians can better match patients with drugs likely to be safe and effective based on their genotype.

Genotype-guided testing panels are now available for many psychotropic drug classes, including:[15]

- Antidepressants
- Antipsychotics
- Anxiolytics
- Stimulants
- Addiction treatment

EVIDENCE IN CLINICAL SETTINGS

There is mounting evidence, particularly in major depressive disorder, of the clinical utility of pharmacogenomic testing, such that some payors now reimburse for them. In randomized, blinded clinical trials in major depressive disorder (MDD), genotype-guided care guided clinical decision-making, resulting in:

- A 1.8-fold increase in the odds of clinical response vs. unguided drug selection[16]

- A significant decrease in the burden of side effects for patients who received genotype-guided treatment vs. patients treated as usual[16,17]

Multiple systematic reviews of the evidence for genotype-guided testing in MDD (vs. conventional care) demonstrated:[18–20]

- Improved remission rates

- Greater tolerability

The evidence suggests that pharmacogenetic testing can play a crucial role in optimizing treatment outcomes, individualizing therapy, and improving the overall management of MDD. These kinds of tools allow psychiatrists to more easily follow clinical practice guidelines, which recommend that certain genetic variations be considered when prescribing several medications used in psychiatry.[21]

By empowering clinicians to select the optimal medication for each patient, genotype-guided testing may also reduce the time needed to achieve an appropriate medication regimen, number of medication switches, and medication dosage requirements.

HARNESSING THE POWER OF COMPREHENSIVE REPORTING

Beyond optimizing the initial prescription, ongoing monitoring of treatment response and side effects is critical to ensure patient safety and therapeutic success. However, systematic tracking of outcomes can be a difficult bridge to cross with the increased caseload of patients in psychiatric care and the need to triage the cases.[22,23]

Emerging digital health platforms now allow clinicians to more easily collect and analyze patient-reported outcomes over time.[24] Providers can monitor subjective measures like depression severity scales (e.g., PHQ-9) and objectively track metrics such as side effects and medication adherence.[25]

Dynamic software platforms for genotype-guided testing can integrate complex analytic capabilities with an automated data-to-insight approach, significantly reducing the need for manual clinician interpretation. This type of advanced tool also allows psychiatrists to perform exploratory analyses regarding potential outcomes for different drug combinations by altering one or more variables.

Ideally, the testing provider continually updates the report as new medications and genetic variation are researched and added to the database. Updated analyses can be compared with the patient's existing medication regimen to determine any potential negative interactions and any possible alternative therapies.

An initial interpretation of the results obtained from the patients genetic profile is displayed in a table below. For each drug examined, the result is indicated according to the following code:

No genetic variants relevant to the treatment have been found. Use as directed.	Need for drug dose monitoring and/or less likelihood of positive response.	⊗ Contraindication
Increased likelihood of positive response and/or lower risk of adverse drug reactions.	Increased risk of adverse drug reactions.	⚠ Combination not advised
		⚠ Monitor parameters → ⬆ Increase dose
		ⓘ Warning / Information → ⬇ Decrease dose

ANTIDEPRESSANTS	
SSRI	
Citalopram *(Celexa®)*	⚠
Escitalopram *(Lexapro®)*	⚠
Fluoxetine *(Prozac®)*	⚠
Fluvoxamine *(Luvox®)*	⚠
Paroxetine *(Paxil®)*	⚠
Sertraline *(Zoloft®)*	⚠
SNRI	
Desvenlafaxine *(Pristiq®)*	⚠
Duloxetine *(Cymbalta®)*	⚠
Venlafaxine *(Effexor®)*	⚠
ATYPICAL	
Bupropion *(Wellbutrin®)*	⚠
Mirtazapine *(Remeron®)*	ⓘ
Trazodone *(Desyrel®)*	⚠
Vortioxetine *(Trintellix®)*	
TCA	
Amitriptyline *(Elavil®)*	⚠
Clomipramine *(Anafranil®)*	⚠
Desipramine *(Norpramin®)*	⚠
Doxepin *(Sinequan®)*	⚠
Imipramine *(Tofranil®)*	⚠
Nortriptyline *(Pamelor®)*	⚠

MOOD STABILIZERS AND ANTICONVULSANTS	
MOOD STABILIZERS	
Carbamazepine *(Tegretol®)*	⚠
Lamotrigine *(Lamictal®)*	
Lithium *(Eskalith®)*	⚠
Valproic Acid *(Depakote®)*	⚠
OTHER MEDICATIONS OF INTEREST	
Eslicarbazepine	⚠
Levetiracetam	
Oxcarbazepine *(Trileptal®)*	⚠
Phenobarbital	⚠
Phenytoin	⚠
Topiramate *(Topamax®)*	
Vigabatrin	
Zonisamide	

ANXIOLYTICS / SLEEP DRUGS	
Alprazolam *(Xanax®)*	
Buspirone *(BuSpar®)*	⚠
Clonazepam *(Klonopin®)*	
Eszopiclone *(Lunesta®)*	
Lorazepam *(Ativan®)*	
Zolpidem *(Ambien®)*	

SUBSTANCE USE	
Methadone	⚠
Naloxone	
Naltrexone	

ANTIPSYCHOTICS	
2nd GENERATION	
Aripiprazole *(Abilify®)*	
Brexpiprazole	
Clozapine *(Clozaril®)*	⚠
Iloperidone *(Fanapt®)*	⚠
Lurasidone *(Latuda®)*	
Olanzapine *(Zyprexa®)*	
Paliperidone *(Invega®)*	⚠
Quetiapine *(Seroquel®)*	
Risperidone *(Risperdal®)*	
1st GENERATION	
Haloperidol *(Haldol®)*	⚠
Perphenazine *(Trilafon®)*	⚠
Pimozide	⚠
Thioridazine *(Mellaril®)*	⊗

ADHD, NARCOLEPSY & BINGE EATING	
STIMULANTS	
Amphetamines *(Adderall®)*	⚠
Lisdexamfetamine	⚠
Methylphenidate *(Ritalin®...)*	⚠
NON-STIMULANTS	
Atomoxetine *(Strattera®)*	

This report of genotype-guided test results integrates complex analytic capabilities with an automated data-to-insight approach, streamlining the interpretation and decision making.

CONCLUSION

Significant challenges exist currently in psychiatry, including the increased demand for mental health services and inefficiencies in conventional prescribing methods that can lead to ADRs and poor outcomes. As a result, many patients continue to struggle with their conditions, leading to severe personal and societal consequences. Genotype-guided prescribing tools offer hope for both patients and their providers: by using the power of data, these tools have been proven to increase efficacy while minimizing side effects. When combined with digital monitoring across the caseload, psychiatrists can transform both their care and their practice.

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About Precision Genetics

Precision Genetics offers innovative solutions and unmatched convenience to personalize medicine for safer and more efficient well care. It is helping evolve a more modern, value-based standard of care resulting in operational efficiencies and lower overall healthcare costs.

About Neuropharmagen®

Neuropharmagen® is a genetically guided decision support tool that streamlines the identification of personalized medication, expediting effectiveness and tolerability and enabling clinicians to provide safer and more effective treatment for patients in need. Its integration into clinical workflows has the potential to revolutionize personalized mental health treatment strategies on a broader scale.

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