Elite Learning Podcast

The Use of Precision Medicine and Biomarkers in Mental Health Treatment

From trial-and-error prescribing to personalized care—how genetics, biomarkers, and emerging science are reshaping mental health treatment

Listen time: ~60 minutes • Audience: RNs, APRNs, NPs, pharmacists, mental health providers • Listen now: elitelearning.com/ce-podcasts

Featured Voices

Host: Dr. Candice Pierce — Faculty with Elite Learning by Colibri Healthcare, and healthcare educator
Guest: Dr. Erica Ramey — DNP, psychiatric mental health nurse practitioner; doctoral research focused on pharmacogenetic testing for treatment-resistant depression at Vanderbilt University

What You'll Learn

- Why current psychiatric prescribing relies heavily on trial and error—and the real cost to patients
- What precision medicine means in psychiatry and how it differs from other medical specialties
- The five major types of biomarkers relevant to mental health treatment
- How pharmacogenetic testing works, what it can and cannot tell clinicians
- The four metabolizer types and their clinical implications for psychiatric medications
- Current evidence on pharmacogenetic testing, including the GUIDED trial and Prime Care study
- Who is, and isn't, a good candidate for pharmacogenetic testing
- Emerging neuroimaging, inflammatory, and microbiome biomarkers on the horizon
- Barriers to adoption of precision medicine in mental health settings
- Ethical concerns including privacy, equity, informed consent, and data ownership
- How precision medicine may reshape roles across nursing, pharmacy, and psychiatry

Key Takeaways

- **Mental health treatment is costly and inefficient:** Only 1 in 3 patients with major depressive disorder achieves remission with their first antidepressant. The U.S. spends $210 billion annually on mental health, yet 40–60% of patients with schizophrenia, bipolar disorder, or major depression don't respond adequately to first-line therapies.
- **Precision medicine means individualized, not algorithmic, care:** Rather than applying a standard treatment protocol, precision medicine uses a patient's unique genetics and biomarkers to guide medication selection, reducing unnecessary trials and adverse effects.
- **Psychiatry lags behind other specialties—but is catching up:** Unlike cardiology or endocrinology, psychiatry lacks clear objective biological tests. The brain's complexity makes this especially challenging, but advances are accelerating.
- **Five key biomarker types in mental health:** Genetic (pharmacogenomics), inflammatory (C-reactive protein/CRP), neuroimaging (fMRI, EEG), physiological (heart rate variability, sleep patterns), and microbiome (gut composition). Each is at a different stage of clinical readiness.
- **Pharmacogenetic testing is the most clinically ready tool today:** Cheek swab or blood draw testing identifies how a patient metabolizes psychiatric medications via genes like CYP2D6 and CYP2C19, covering antidepressants, antipsychotics, mood stabilizers, anxiolytics, and stimulants.

- **Four metabolizer types guide prescribing decisions:** Normal metabolizers process drugs as expected. Ultra-rapid metabolizers clear drugs too quickly for benefit. Intermediate metabolizers may need dose adjustments. Poor metabolizers accumulate drugs, significantly increasing side effect risk.
- **Testing narrows options—it does not guarantee outcomes:** Pharmacogenetic results can eliminate medications likely to cause side effects, but cannot confirm which drug will treat the underlying cause of depression. The cause of depression varies between individuals even with identical diagnoses.
- **Evidence is mixed but improving:** The GUIDED trial found no significant difference at 8 weeks; the Prime Care study showed modest benefits. Cost-reduction evidence is stronger. Testing may reduce medication trials from 10 to 4, lowering hospitalization risk.
- **Best candidates for pharmacogenetic testing:** Patients with treatment-resistant depression, significant adverse medication reactions, polypharmacy, or those who request it. It is generally not recommended as a first-line tool before any medication trials.
- **Insurance coverage varies:** Medicare and Medicaid often cover testing. Private insurance may cover it once in a lifetime. If better testing becomes available in the future, insurance is unlikely to pay for repeat testing, which is a key consideration for timing.
- **Neuroimaging biomarkers are promising but not yet clinical tools:** fMRIs can identify depression subtypes (e.g., anhedonia patterns); EEGs may predict treatment resistance. Both are expensive and currently research-stage. At-home EEG devices are in development.
- **Inflammation is a significant and underrecognized factor:** 22–40% of individuals with depression show elevated inflammation. Elevated CRP may indicate treatment resistance and could shift medication choices (e.g., toward TCAs like nortriptyline over SSRIs). Treating inflammation itself may eventually be part of psychiatric care.
- **The gut-brain connection is real but not yet clinically actionable:** Depressed patients show different gut microbiome compositions. A fecal transplant study transferred depressive symptoms to mice. Probiotics may offer modest benefit with low risk, but significant clinical application is not yet supported.
- **Whole-person care is the future of psychiatry:** Mental illness is not limited to the brain. It is experienced throughout the body. Hormones, lifestyle, trauma history, and inflammation all play roles. Functional/integrative medicine principles are increasingly relevant to psychiatric care.
- **Major barriers to adoption include:** Cost, time, provider education gaps, lack of standardized EHR infrastructure, privacy risks, and health equity concerns. Pharmacogenetic testing is not yet standard in medical or NP education.
- **Pharmacists are key precision medicine partners:** Pharmacists have the deepest expertise in drug metabolism and can help interpret genetic results, optimize dosing, and use compounding when needed. Expanding their role in mental health teams improves outcomes.
- **Equity must be built in from the start:** Most research has been conducted in European ancestry populations. Universal access to testing and diverse research populations are essential, not just ethically, but scientifically, to generate better data for everyone.
- **Ethical concerns require proactive attention:** Key issues include data privacy (genetic data stored in potentially breachable repositories), informed consent complexity, implications for family members, once-in-a-lifetime insurance coverage, and the right to not know genetic risk information.

☑ Do This Next

- When a patient has failed two or more medication trials, consider initiating a conversation about pharmacogenetic testing and whether it's appropriate for their situation.

- Before ordering testing, review which company you're using. Understand how they store genetic data, whether it's de-identified, and whether it can be sold.
- Educate patients that pharmacogenetic results are a guide, not a guarantee. Set realistic expectations before testing to prevent discouragement.
- Check whether your patient's insurance (Medicare, Medicaid, or private) covers pharmacogenetic testing before ordering, and discuss the once-in-a-lifetime coverage consideration.
- For patients with elevated CRP or known inflammatory conditions alongside depression, consider whether inflammation may be contributing to treatment resistance.
- Incorporate physiological biomarker tracking (wearables, sleep data, heart rate variability) into patient monitoring where accessible.
- Collaborate with pharmacists when interpreting pharmacogenetic results. They are the experts in drug metabolism and can optimize medication strategy.
- Stay current through CMEs, podcasts, and annual updates as this field is evolving rapidly and is not yet standard in most clinical training programs.
- Advocate for diverse patient populations to be included in precision medicine research to ensure findings are generalizable and equitable.

? 3 Quick Clinical Assessment Questions

Use these to evaluate whether a patient may benefit from pharmacogenetic testing:

- **1. Medication history:** "How many different psychiatric medications have you tried, and what happened with each one? Did they help, cause side effects, or both?"
- **2. Adverse reactions:** "Have you ever had to stop a medication because of a serious or intolerable side effect? Did any reaction require medical attention or hospitalization?"
- **3. Patient goals and readiness:** "Would you be interested in a test that could help us narrow down which medications are less likely to cause side effects for you, based on your genetics? I can explain what it can and can't tell us."

Red Flags & Clinical Cautions

- Patient has stopped psychiatric medications abruptly based on online information or self-directed genetic testing without clinical guidance
- Clinician orders pharmacogenetic testing without adequate training to interpret results. Misinterpretation can lead to inappropriate prescribing
- Patient or family has unrealistic expectations that testing will identify 'the one medication that will definitely work'
- Genetic data being stored with a company whose privacy and data-sharing policies are unknown or unclear
- Testing ordered for a patient who is currently stable and doing well. Cost and once-in-a-lifetime coverage may not justify testing at this time
- Patients from underrepresented populations receiving results interpreted primarily from European ancestry research data
- Providers applying pharmacogenetic results without considering the full clinical picture (diagnosis, comorbidities, patient preferences)
- Patients with a history of significant adverse reactions being started on new medications without first exploring available biomarker guidance

Clinical Spotlight

- **CYP2D6 & CYP2C19, The Key Genes:** CYP2D6 governs metabolism of most antidepressants and antipsychotics. CYP2C19 is critical for SSRIs and tricyclics. Pharmacogenetic testing reports results as normal, intermediate, ultra-rapid, or poor metabolizer for each gene. Each with distinct clinical implications.
- **The GUIDED Trial:** The largest randomized controlled trial of pharmacogenetic testing in psychiatry found no statistically significant difference in outcomes at 8 weeks between guided and unguided treatment groups. However, cost-reduction data and longer-term studies show more promising results.
- **Inflammatory Biomarkers in Depression:** Elevated C-reactive protein (CRP) is found in 22–40% of depressed patients and is associated with treatment resistance. High CRP may indicate that inflammation, not serotonin deficiency, is the primary driver, potentially requiring a different treatment approach entirely.
- **The Fecal Transplant Study:** Researchers transferred fecal matter from depressed humans to mice and observed depressive symptoms in the mice, demonstrating a transmissible gut-brain connection. This is not clinically applicable but represents a significant scientific finding in microbiome research.
- **Metabolizer Types at a Glance:** Normal = standard dosing expected to work. Ultra-rapid = drug clears too fast, likely ineffective. Intermediate = yellow light, monitor and adjust. Poor = drug accumulates, high side effect risk. Results are typically displayed as red/yellow/green for clinical ease.
- **L-Methylfolate & MTHFR:** Many pharmacogenetic panels also test for MTHFR gene variants affecting L-methylfolate conversion. This has significance in depression treatment, as L-methylfolate is a cofactor in neurotransmitter synthesis and may be used as an adjunct in some patients.

Conversation Starter

"When a patient asks why their antidepressant isn't working, how do you explain the role of genetics and biology in medication response—and how do you introduce the idea of pharmacogenetic testing without overpromising results?"

Nurse Leaders & Educators: Consider developing a team protocol for when and how to discuss pharmacogenetic testing with patients—including who orders it, who interprets it, and how results are communicated. Pharmacists should be included in this workflow.

Resources & Links

- Episode page: https://elitelearning.com/ce-podcasts
- CE courses: https://EliteLearning.com
- National Institute of Mental Health (NIMH): https://www.nimh.nih.gov
- PharmGKB (Pharmacogenomics Knowledge Base): https://www.pharmgkb.org
- CPIC Guidelines (Clinical Pharmacogenomics Implementation Consortium): https://cpicpgx.org

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