What Every Psychiatric Clinician Should Know About TMS

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Radial Health

Silver Hill Hospital Grand Rounds | Moderated by Dr. Katzman

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Disclosures

1

Carlene MacMillan, MD

- Radial: Chief Product Officer, equity
- AMPA: equity, advisor
- EMOBOT: consultant, equity
- CTMSS: Exec Board, Insurance Committee Co-Chair
- FACTMS: board member

2

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- Radial: Chief Medical Officer, equity
- AMPA: equity, consultant
- BrainsWay: equity, Principal Investigator
- Magnus Medical: consultant, PI
- Mind Medicine: equity, PI
- Neurolief: Chief Medical Officer

Educational Objectives

1

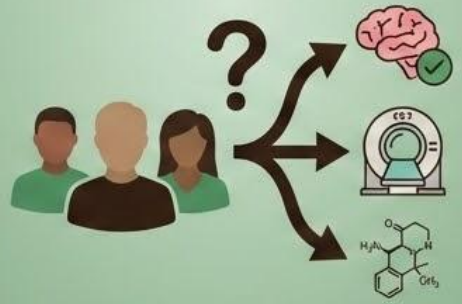
Mechanisms

The neurophysiology of TMS -- how different protocols produce therapeutic effects.

2

Patient Selection

Who gets TMS, who doesn't, and how it compares to ECT and ketamine.



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Clinical Integration

How to refer, navigate insurance, measure outcomes, and set expectations.

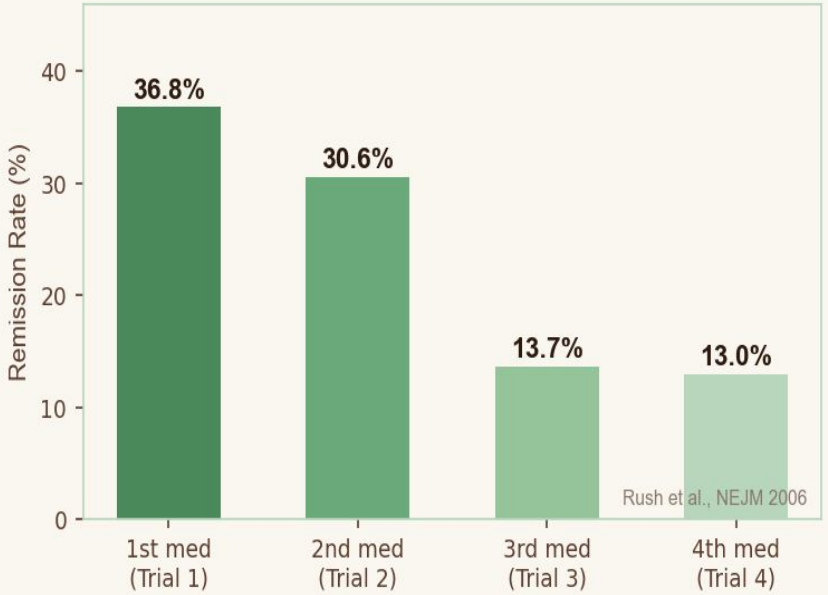
First antidepressant works for 1 in 3 people.

- With each failed trial, remission probability drops

-- from 37% on trial 1 to 13% on trial ¾*

- **~30% of patients never achieve remission despite multiple medication trials**
- A 2023 reanalysis: antidepressant efficacy is even further overstated after publication bias

**(this is data from STAR*D, which was re-evaluated in 2025 with even less enthusiasm)*



This is the treatment gap TMS was built to fill.

2008.

TMS was FDA-cleared for depression.

17 years ago.

Why does it still feel new?

TMS is not experimental. It hasn't been since 2008.

58%

response
real-world

37%

remission
real-world

0.55

Cohen's d
vs sham

5 FDA-cleared indications:

- MDD (2008) → OCD (2018) → Smoking Cessation (2020) → Anxious Depression (2021) → Adolescent MDD (2023-25)

Medicare: Covered by all MACS vs LCDs
Medicaid: Some states (most recently in NY)
Most commercial payers: covered
Evernorth/Cigna (2026): NO prior auth

Everything You've Heard About TMS Is Wrong.

The Myth

- "TMS is a last resort"
- "Only for treatment-resistant patients"
- "Insurance won't cover it"
- "I don't have a TMS machine"
- "Too burdensome -- 6 weeks daily"

The Reality

- Response is better with fewer prior med failures
- FDA-cleared after just 1 failed trial
- Commercial + Medicare coverage is broad and growing
- Referral is the skill. You don't need the machine.
- Theta burst = 3 minutes per session
- Protocols as short as 1- 5 days

Agenda

01
How TMS Works
Mechanisms, physics, protocols, devices

02
Who Is the Right Patient?
Indications, contraindications, selection

03
Making It Work in Practice
Referral, insurance, measurement, maintenance

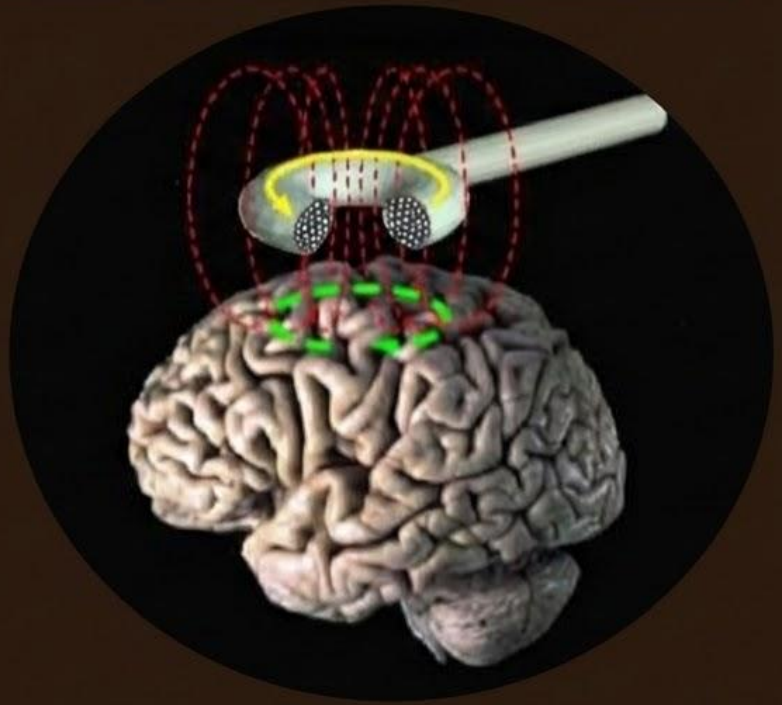
04
What's Next + What You Can Do
Future directions and 5 concrete next steps

01

How TMS Works

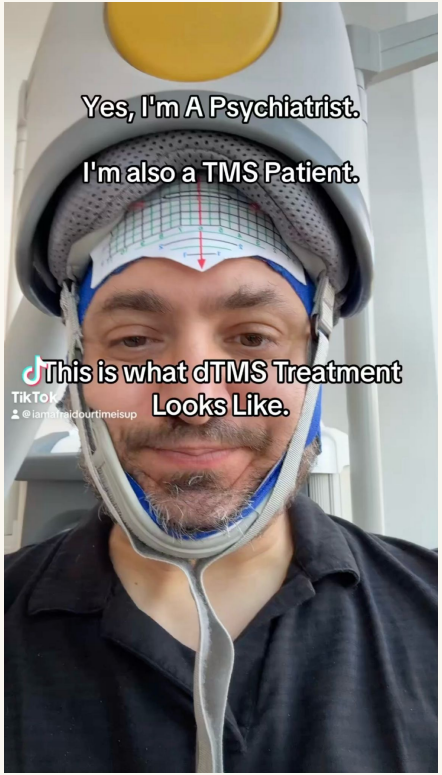
A changing magnetic field can change a depressed brain.

- Faraday's law: a changing magnetic field induces an electrical current
- The coil on the scalp generates a field that passes through bone -- no electricity through skin
- The induced current depolarizes neurons in the underlying cortex
- Magnetic fields pass through tissue without impedance. Safe. No anesthesia.



The coil targets a 2-3 cm patch of cortex. That's it.

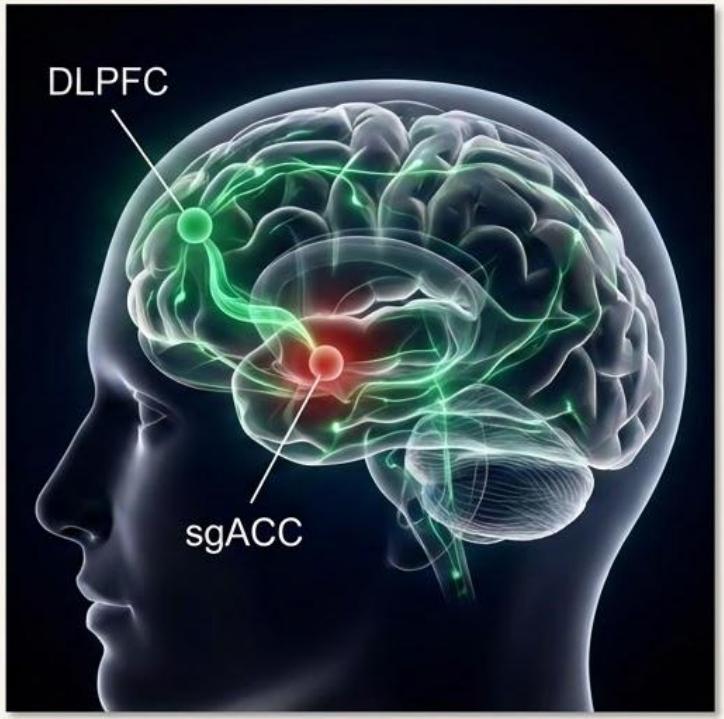
- **Figure-8 coils**: focal stimulation to ~1.5-2 cm depth (superficial cortex)
- **H-coils (BrainsWay):** “deeper penetration” -- relevant for OCD and MDD? H1 = 17 cc target, H7= 75cc target.
- **Motor threshold (MT):** minimum intensity causing a visible finger twitch -- individual calibration
- Treatment delivered at 110-120% of MT -- individualized dosing, not one-size-fits-all



We're not stimulating a spot. We're modulating a circuit.

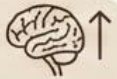
Target: left dorsolateral prefrontal cortex (DLPFC) -- functionally anticorrelated with the sgACC

- The sgACC is hyperactive in depression -- DLPFC stimulation down-regulates it indirectly
- Fox et al. (2012): resting-state fMRI identified the DLPFC site most anticorrelated with sgACC
- This is circuit medicine. The effect propagates through connected brain regions.



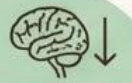
“High Frequency Excites. Low Frequency Inhibits”

High Frequency (10-20 Hz) ↑



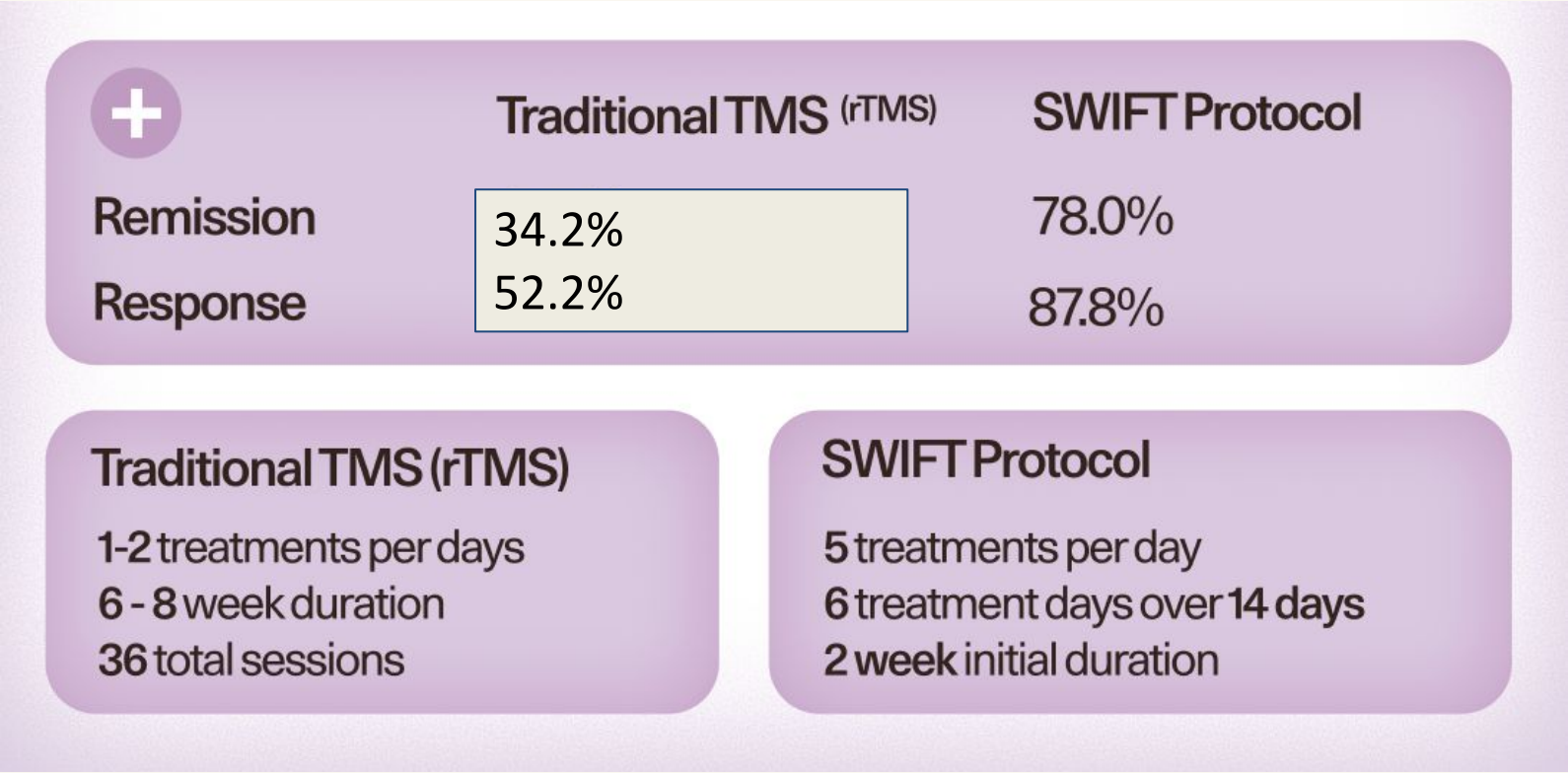
- Increases cortical excitability
- Standard protocol for MDD treatment
- Applied to left DLPFC
- Mechanism: long-term potentiation (LTP)
- Most common in clinical practice

Low Frequency (1 Hz) ↓



- Decreases cortical excitability
- Alternative for MDD: right DLPFC suppression
- Mechanism: long-term depression (LTD)
- Also: theta burst (iTBS/cTBS) -- 3-minute patterned protocol
- THREE-D trial: iTBS = 10Hz rTMS. Same result.

Traditional and Accelerated FDA Cleared Protocols



37 minutes. Then 3. Same efficacy.

37

min/session

Standard rTMS
10 Hz

vs

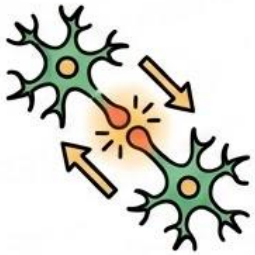
3

min/session

Theta Burst
iTBS

THREE-D Trial (Blumberger, Lancet 2018) -- iTBS non-inferior to 10 Hz rTMS. N=414. Double-blind RCT.

This is why 30 sessions. The brain is physically changing.

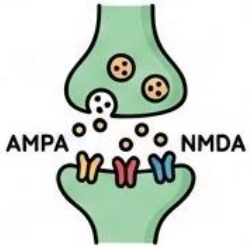


LTP: Synaptic Strengthening

High-frequency stimulation strengthens synaptic connections -- repeated sessions accumulate change

BDNF: Neuroplasticity Driver

TMS upregulates brain-derived neurotrophic factor, driving neuroplasticity.



Glutamate/AMPA-NMDA Pathway

TMS induces glutamate release -- same downstream plasticity as ketamine.

Clinical Implication: The Course IS the Treatment

A single session has no durable effect. The course IS the treatment.

The target changes with the diagnosis.

- **MDD**: left DLPFC (excitatory) -- or right DLPFC (inhibitory) for bilateral protocol
- **OCD:** supplementary motor area (SMA) via CSTC loop -- H7 deep TMS coil
- **PTSD:** right DLPFC connectivity to sgACC/amygdala -- Siddiqi et al. (2021)
- **Anxious depression:** bilateral protocol with distinct parameters -- FDA-cleared 2021
- **Smoking cessation:** bilateral DLPFC + insula -- FDA-cleared 2020

Many Cleared TMS Systems. One Referral Skill.

Device	Cleared Indications	Key Note
NeuroStar (Neuronetics)	MDD, anxious depression, adolescent MDD 15-21	Most widely deployed
BrainsWay	MDD, OCD, anxious depression	H-coil for OCD -- essential
MagVenture	MDD, adolescent MDD	Common in research + clinical
AMPA	Accelerated TMS, MDD	Accelerated protocols; expanding access
Magnus Medical	SAINT (accelerated, fMRI-guided)	Academic centers; fMRI required
MagStim	MDD, multiple clearances	Research settings, international

79% remission. In 5 days. SAINT.

79%

remission

Cole et al., NEJM Evidence 2022

fMRI-guided individualized target

10 sessions/day over 5 days

1,800 pulses/session (3× standard dose)

- Access: Magnus Medical system; fMRI required before treatment
- Academic centers now -- expanding to community practices
- Ampa, BrainsWay, and others building accelerated protocols *without fMRI*
- Rapid SI resolution was also demonstrated in the RCT. Replication trial has 50% remission rate with similar design.

Objective 1 Checkpoint: How TMS Works

1

TMS uses Faraday induction to modulate cortical circuits. The target changes with the diagnosis -- DLPFC for depression, SMA for OCD, right DLPFC connectivity for PTSD.

2

Protocol matters. Theta burst = 3 minutes, same efficacy as 37-minute rTMS. Three course types: standard (6 weeks), accelerated (5 days), maintenance (preservation).

3

SAINT: fMRI-guided, 79% remission in 5 days. Access is expanding. AMPA and others are building accelerated protocols that don't require fMRI.

02

Who Is the Right Patient?

17 Years of FDA Clearances. The Evidence Is Not the Problem.

Coverage is real:

- Medicare: all MACS cover TMS, no LCD
- Most commercial Payers: cover MDD, many cover OCD and anxious depression
- Adolescent coverage expanding rapidly. Highmark BCBS now covers age 11+.
- Evernorth/Cigna (2026): prior auth eliminated entirely for TMS

58% responded. 37% remitted. In real patients.

- NeuroStar ATC Registry (Carpenter 2012): N=307 real-world patients -- not a controlled trial
- Pivotal RCT (O'Reardon 2007): N=301, double-blind, sham-controlled. Statistically and clinically significant.
- Effect size vs sham: Cohen's d ~0.55 -- comparable to antidepressants vs placebo

OCD and Anxious Depression: Two Cleared Indications Often Missed.

OCD (FDA-cleared 2018)

- BrainsWay H7 coil: targets SMA/CSTC loop
- Carmi et al. (2019): 38% response vs 11% sham
- Real-world response: ~62.7%
- Provocation protocol: patient engages fear stimuli
- TMS + ERP is better than TMS alone

Anxious Depression (FDA-cleared 2021)

- Bilateral protocol: right LF + left HF combination
- Outperforms standard unilateral in anxious subtype
- ~40-50% of MDD patients have anxious features
- Specify the subtype explicitly on the referral
- Most commercial payers cover this indication

Teen depression is epidemic. Access is finally catching up.

- Multiple devices FDA-cleared for ages 15-21 (NeuroStar, MagStim, MagVenture, Apollo, BrainsWay)
- Highmark BCBS expanded coverage to age 11 -- ahead of FDA clearance for that age group
- SSRI response rates in adolescents are modest -- TMS fills a real gap
- Practical barriers: school schedules, parental consent, stigma. Not the evidence.

Who Responds Best? And Who Is a Challenge?

Positive Predictors

- Fewer prior medication failures (1-2 vs 3+)
- Absence of psychotic features
- Younger age -- more neural plasticity
- Anxious depression subtype
- No high-dose benzodiazepine use

Watch For These

- High BZD dose
- Active heavy substance use
- Poor adherence potential (5x/week)
- Undiagnosed bipolar
- Many prior failures: still worth trying; response is lower but meaningful

Almost nobody is excluded. The contraindication list is short.

- Ferromagnetic metal within or near the head -- aneurysm clips, some shrapnel, certain DBS devices
- Cochlear implants -- most common absolute contraindication in clinical practice
- Standard MRI-compatible implants, dental work, pacemakers: generally fine
- Key screening question: 'Have you had brain surgery or a head implant?'

Relative contraindications require clinical judgment, not automatic exclusion.

- Epilepsy / seizure history: risk-benefit discussion; TMS seizure rate ~1 in 30,000 sessions
- Pregnancy: not contraindicated; discuss with OB; untreated depression has risks too
- Cardiac pacemakers / defibrillators: keep coil away from device; consult cardiology
- Active suicidal ideation with plan: TMS for chronic SI is appropriate; not for acute psychiatric emergency unless in appropriate setting and monitoring

Case 1: When to Refer

"Maria," 34-year-old woman with recurrent MDD

Two prior adequate antidepressant trials: sertraline 200 mg x 4 months (sexual side effects); venlafaxine 225 mg x 5 months (partial response only). PHQ-9: 18. No SI. No metal implants.

The clinical question:

- TMS candidate? Yes. 2 failed adequate trials, significant symptoms, no contraindications.
- When to mention TMS? Now -- not after failures 3 and 4.
- Insurance: commercial payer, 2 failed trials likely meets criteria. Verify plan.
- Referral includes: diagnosis, med trials with dose/duration/outcome, PHQ-9 score.

OCD: best results when TMS opens the door for ERP.

- Primary candidate: OCD after 2+ SRI trials (SSRI or clomipramine) at adequate dose/duration
- Best evidence: moderate-severe OCD (Y-BOCS 20+) who are engaged or willing to engage in ERP
- Provocation protocol: fear-inducing stimuli before each session -- TMS + exposure together
- TMS + ERP is better than TMS alone. Refer to a center that does both or coordinates w/ ERP therapist.

The Off-Label Landscape Is Growing.

Condition	Target	Evidence
PTSD	Right DLPFC	RCTs + observational -- Siddiqi 2021
Chronic pain	Motor cortex / DLPFC	Emerging RCTs; promising
Tinnitus	Left temporoparietal	Small RCTs; mixed results
Bipolar depression	Left DLPFC	Off-label; requires mood stabilizer
Stroke rehab	Perilesional cortex	Pilot studies; promising

TMS vs ECT: Different Tools. Different Patients.

TMS

- Outpatient. No anesthesia.
- Patient awake and conversational throughout
- No cognitive effects -- biggest advantage
- No driving restriction. No recovery day.
- Benefit builds over 6 weeks.
- For: ambulatory patients, moderate severity

ECT

- General anesthesia required
- Highest response rates (80-90%) for severe MDD w/ psychosis
- Memory effects possible (usually transient)
- Fast onset -- response in 2-3 weeks
- First-line when severe MDD w/ psychosis,, catatonia

TMS vs Ketamine: Complementary, Not Competing.

TMS

- Durable -- circuit-level structural change
- No dissociation; fully ambulatory
- Insurance-covered for MDD and OCD
- Takes 4-8 weeks to reach full effect
- Ideal for: building lasting remission

Ketamine / Esketamine

- Rapid -- hours to days
- Acute SI: ketamine is uniquely effective
- Costly maintenance; dissociation during treatment
- Monitoring required (REMS for Spravato)
- Ideal for: speed, crisis, bridging

Authorizing TMS upfront is cheaper than paying for failed trials and hospitalizations.

- ICER analysis: TMS cost-effective at <$50,000 per QALY -- well within the $100-150k threshold
- vs antidepressants alone: TMS produces more QALYs at 3 and 5 years
- Downstream savings: reduced hospitalizations, ER visits, and productivity loss offset the upfront cost
- Coverage trajectory: this is why payers are expanding TMS coverage, not contracting

- Lifetime direct treatment costs, and QALYs identified rTMS as the dominant therapy compared to antidepressant medications (i.e., lower costs with better outcomes) in all age ranges, with costs/improved QALYs ranging from $2,952/0.32 (older patients) to $11,140/0.43 (younger patients). One-way sensitivity analysis demonstrated that the model was most sensitive to the input variables of cost per rTMS session, monthly prescription drug cost, and the number of rTMS sessions per year.

Objective 2 Checkpoint: Who Is the Right Patient?

1

MDD with 1-4 failed medication trials is the core indication. Don't wait for failure 5. Response is better with fewer prior failures. Offer it after failure 1 or 2.

2

Absolute contraindications are narrow: ferromagnetic metal near the head and cochlear implants.

3

TMS and ECT are complementary.

Ambulatory with moderate severity: TMS.

Hospitalized with catatonia or psychotic depression: ECT.

Patients in crisis: consider ketamine + accelerated TMS first, preservation TMS for durability.

03

Making It Work in Practice

Standard TMS: No anesthesia. No negative cognitive effects.

30 SESSIONS
5 days/week for 6 weeks -- or since July 2024, 2 sessions/day (18 treatment days)

3-37 MIN
per session

Weeks 1-2: patients often feel nothing. This is normal. Neuroplasticity is building.

FULL BENEFIT
may not appear until 4-8 weeks post-course -- set this expectation before the course starts

Acute side effects: mild scalp discomfort or headache in week 1. Resolves spontaneously.

What Patients Ask. What to Say.

"Will it hurt?"

- "Less than the dentist. It's a tapping sensation on your scalp."
- "Mild headache possible the first week -- Tylenol works."
- "Can I drive? Yes. No sedation at all."
- "Do I stop my meds? No, not during TMS. TMS is additive."
- "How soon will I feel better? Give it the full course -- sometimes 4-8 weeks after you finish."

What They're Really Worried About

- Memory effects: "None. This is not ECT."
- Sexual side effects: "None."
- Weight change: "None."
- Seizure: "About 1 in 30,000 sessions. Vanishingly rare."
- "Will it work?" -- Honest answer: 58% respond in real-world practice.

Continue medications. But watch the benzodiazepines.

- TMS is additive -- do not stop current pharmacotherapy during the course or right before.
- BZD caution: benzodiazepines may blunt cortical plasticity -- the mechanism TMS depends on
- High-dose standing BZD (4+ mg lorazepam equivalent/day): discuss taper before or during TMS
- Lamotrigine, Gabapentin etc mean higher power will be needed and more discomfort but not contraindicated
- Concurrent CBT, psychodynamic therapy or behavioral activation may enhance outcomes -- the plasticity window works in both directions

You cannot manage what you cannot measure: PHQ-9 and MADRS

- PHQ-9 every two weeks -- detects early response and non-response in real time
- MADRS at intake, mid-course, and end of course -- gold-standard for payer documentation and research
- CGI-S and CGI-I at each visit -- simple, fast, payer-friendly
- No PHQ-9/MADRS improvement by week 3-4: signal to re-evaluate, not to give up

Emerging Passive Sensing Measures: Voice, Emotional Expressivity can detect changes earlieer

Case 2: The Partial Responder

"James," 47-year-old man completing 6-week TMS course for MDD

PHQ-9: 22 baseline → 19 week 2 → 17 week 4 → 15 week 6. 'A little better but not where I hoped.' Sleep improved. Appetite back. Still has low energy and anhedonia. No BZD use. MT stable.

What the numbers tell you:

- Is this a failure? No. PHQ-9 moved 7 points. Partial response is common and clinically meaningful.
- Options: extend 10 sessions; medication augmentation; observe post-course.
- Evidence: partial responders often continue improving 4-8 weeks post-course.
- Without the PHQ-9 trajectory you cannot have this conversation. Measurement is the intervention.

The Referral Is the Intervention.

FAILS: *"Patient tried Sertraline"*

No dose. No duration. No reason stopped. This gets denied.

WORKS: *"Sertraline 200 mg x 4 months -- discontinued, sexual side effects; adequate trial"*

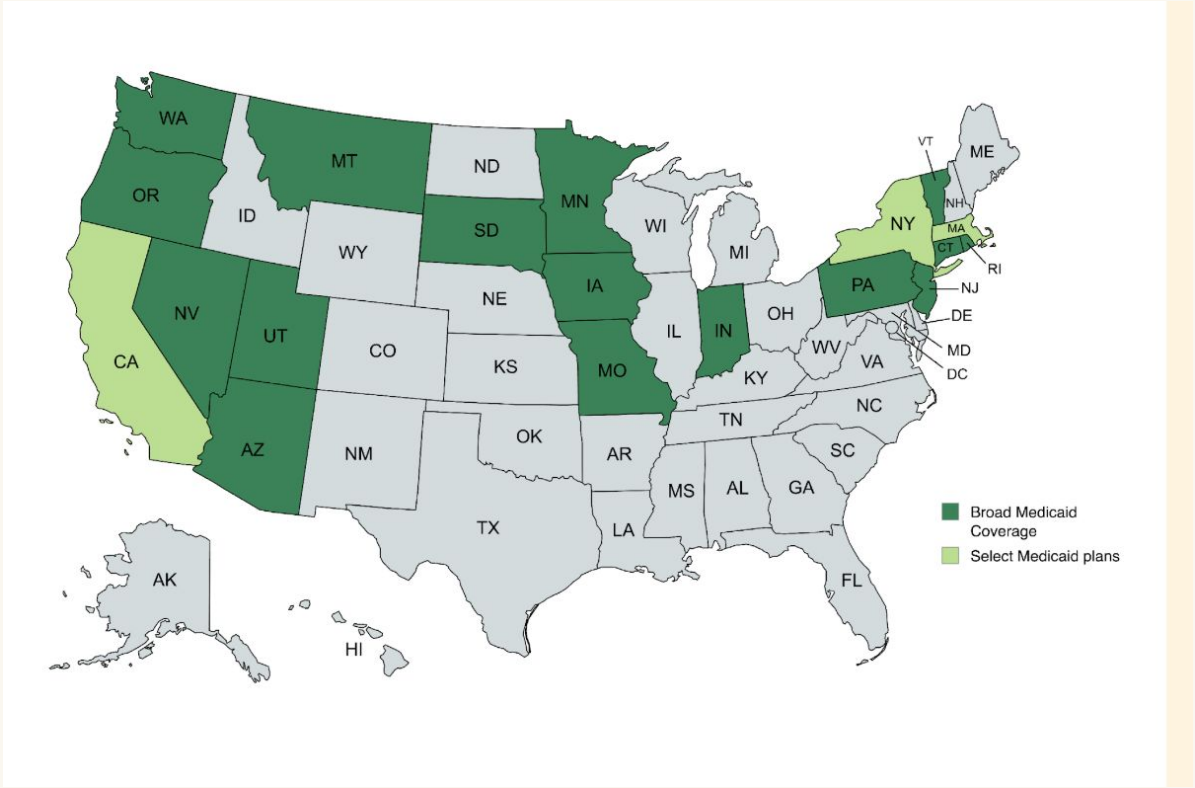
Diagnosis + PHQ-9 score or MADRS score + 1 sentence per failed trial. That's the whole referral.

Required elements: Diagnosis • PHQ-9 score • Each failed trial (drug, dose, duration, reason stopped)

Coverage Is Real. And Getting Better.

Payer	Covered	PA Criteria	Notes
Medicare	MDD (LCDs in every MAC)	1-3+ failed trials (by MAC)	MADRS/HDRS-17 required
Most commercial	MDD, OCD, anxious depression	Typically 2-4 failed trials	PHQ-9 + med trial docs
Evernorth/Cigna	**MDD -- NO PRIOR AUTH (2026)**	**PA eliminated entirely**	**★ Verify enrollment**
Highmark BCBS	**MDD, adolescent (age 11+)**	**2+ failed; accelerated covered**	**★ Ahead of FDA**
Medicaid	Variable by state	Often limited; expanding	Most restrictive; advocate

Medicaid Coverage of TMS (as of mid 2025)



The most common denial reason is preventable documentation failure.

- Required: drug name, dose, duration, outcome -- for each failed trial
- 'Patient tried Zoloft' fails. 'Sertraline 200 mg x 4 months, discontinued, sexual side effects' passes.
- Document prior psychotherapy trials to best of ability, especially if they were private pay
- Severity documentation: PHQ-9 or MADRS demonstrating moderate-severe depression
- CTMSS model authorization letters available to members at ctmss.org -- use them. They work.

2026: Three Coverage Wins Worth Knowing.

Evernorth (Cigna)

Eliminated prior authorization for TMS entirely. First-of-its-kind policy nationally. No PA = immediate access.

Highmark BCBS

Covers accelerated TMS. Age threshold lowered to 11 for adolescent MDD -- ahead of FDA clearance.

Premera Blue Cross

Progressive policy incorporated into CTMSS recommended MDD coverage policy. Signals broader movement.

Source: CTMSS Insurance Committee Report, March 2026

A denial is not a final answer. It is the beginning of a conversation.

- Peer-to-peer review: call the medical director. Clinical conversations overturn administrative denials.
- Written appeal: CTMSS model letters available at ctmss.org for members
- Mental health parity law (MHPAEA): payers must cover behavioral health on equal terms
- External review: state-mandated in most states; use it if internal appeals fail

Before calling TMS a failure, check four things.

Motor threshold: was it recalibrated? Has it shifted? Under-dosing is a a treatable cause.

Benzodiazepines: was a high-dose BZD started or increased during the course?

Missed comorbidity: undiagnosed bipolar II, ADHD, active substance use, untreated trauma

Timing: full benefit often arrives 4-8 weeks post-course. Have you waited?

Objective 3 Checkpoint: Making It Work

1

The referral formula: diagnosis + PHQ-9 score + each failed trial (drug, dose, duration, reason stopped). One paragraph. That is the whole referral.

2

Coverage is real and getting better. Evernorth eliminated prior auth. Highmark expanded to age 11. Most commercial patients with 2+ failed trials will be covered.

3

Measure every session with PHQ-9. MADRS at intake, mid, and end. Set the expectation: weeks 1-2 may feel like nothing. Full benefit can arrive weeks after the course ends.

04

What's Next + What You Can Do Tomorrow

The next version of TMS is coming. Fast.

Advancements in precision, access, and new modalities.

Precision Targeting

AI-guided fMRI individualization -- SAINT-level precision for standard practices.

Accelerated Protocols

5-day intensive courses moving from academic to community access.

TMS + Neuroplastinogens

D-Cycloserine, sequential protocols with ketamine; shared AMPA-receptor pathway

Home TMS

FDA breakthrough device designation granted. The clinical-to-home transition is real.

The evidence is not the barrier. Access and awareness are.

- TMS is concentrated in urban academic centers -- rural patients travel 90+ minutes per session
- Medicaid coverage is inconsistent across states -- the most vulnerable patients have the worst access
- Adolescent TMS access is expanding but still limited despite new FDA clearances
- CTMSS (Insurance Committee) and FACTMS are actively advocating for expanded parity coverage
- PULSES Courses through CTMSS

What You Can Do Tomorrow

1. **Identify 2-3 TMS referral partners in your area.**
   Know who you are sending patients to before you need to.

2. **Offer TMS after 2 failed medication trials. Not 4. Not 5.**
   Response rates are better with fewer prior failures. The timing matters.

3. **Add PHQ-9 and MADRS to your routine for every MDD patient.**
   PHQ-9 every visit. MADRS at intake, mid-course, and end. You cannot track without measurement.

4. **Learn the prior auth formula for your top 2 payers.**
   Drug name, dose, duration, reason stopped. One sentence per trial. That is it.

5. **Tell patients TMS is an option -- not a last resort.**
   This is the most important mindset shift in this room.

Five Things to Remember: TMS Clinical Pearls

1. TMS is Established, Not Experimental.
17-year evidence base, FDA clearances for 5 indications. Broad and growing insurance coverage. It is not a last resort.

2. Patient Selection is Learnable Quickly.
Core candidates include MDD (1-4 failed trials), OCD (after 2 SRI failures), anxious depression, and adolescents (15+). Absolute contraindications are narrow.

3. The Referral is the Intervention.
Build relationships and know your local TMS partners for seamless patient handoffs.

4. Measure to Manage.
Consistently use PHQ-9 and MADRS scales to track progress and demonstrate outcomes.

5. Document Thoroughly, Offer Earlier. Complete documentation of prior medication trials (dose, duration, outcome) is crucial. Don't wait; offer TMS as an earlier treatment option.

Thank You

Q&A moderated by Dr. Katzman

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