# ACCELERATED TRANSCRANIAL MAGNETIC STIMULATION (aTMS):
## Advancing Speed and Accessibility in Neuropsychiatric Care

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### Executive Summary

Accelerated transcranial magnetic stimulation (aTMS) refers to treatment paradigms in which multiple TMS sessions (≥2) are administered per day, thereby shortening the overall treatment course relative to conventional once-daily protocols. This approach can be applied to established rTMS and iTBS therapies and is intended to address practical limitations of standard care, including extended treatment duration and associated barriers to access, adherence, and treatment completion.

Across randomized controlled trials, observational studies, and real-world data, aTMS demonstrates antidepressant efficacy broadly comparable to standard TMS. Reported response rates typically range from 40–60%, with remission rates between 25–40% in routine clinical settings. While high-intensity protocols i.e., 10-20 treatments per day have reported higher remission rates and faster symptom improvement, these findings still require further confirmation in larger multi-arm randomized controlled trials.

The safety and tolerability profile of aTMS appears comparable to conventional once-daily TMS, with mild and transient adverse events and no clear increase in serious risks across studied protocols.

MagVenture's most recent FDA clearance, granted in May 2026 (K260189), further broadens clinical access to Accelerated TMS by permitting 2–10 treatments per day across four selected protocols supported by the growing clinical literature reviewed in this white paper.

Overall, aTMS can be understood as a time-compressed extension of established TMS practice, offering a flexible approach to treatment delivery while maintaining established effectiveness and safety.


*Keywords: Accelerated TMS; Transcranial Magnetic Stimulation; Intermittent Theta Burst Stimulation; Treatment-Resistant Depression; Major Depressive Disorder; Neuromodulation; DLPFC Targeting; Clinical Accessibility.*

## Introduction to Accelerated TMS

Major depressive disorder (MDD) remains a leading cause of disability worldwide, with patients failing to achieve remission with first-line treatments. Evidence from large studies such as STAR*D shows that remission rates decline across successive treatment steps, highlighting the challenges of treatment resistance and lengthy treatment schedules[1,2].

Repetitive TMS (rTMS) is an established non-invasive treatment option for patients who do not respond adequately to pharmacotherapy. However, conventional TMS protocols require daily sessions over 4–6 weeks, creating practical barriers related to time commitment, clinic capacity, and patient adherence.

Accelerated TMS (aTMS) has been developed to address these challenges by increasing treatment density, delivering multiple sessions per day, and thereby shortening the overall treatment course. Importantly, this approach does not introduce a fundamentally new mechanism but rather modifies the delivery of established stimulation paradigms. aTMS should therefore be understood as an optimization of treatment delivery, aimed at improving access and flexibility within the broader framework of depression care.

## History of accelerated TMS

The development of aTMS represents a gradual and well-documented evolution from conventional TMS paradigms toward increasingly time-efficient, high-dose treatment strategies.

TMS was initially established for major depressive disorder using a conventional once-daily treatment schedule, typically delivered over 20–30 sessions. These protocols formed the clinical and regulatory foundation for TMS in depression, including FDA-cleared systems for patients who had not achieved adequate improvement with antidepressant medication[3,4].

Building on this foundation, early studies in the late 2000s and early 2010s evaluated whether multiple TMS sessions could be delivered safely within shorter treatment schedules[5-8]. From approximately 2015 onward, broader clinical literature supported the feasibility of twice-daily rTMS, with reports of clinical response, acceptable tolerability, and in some studies earlier symptom improvement[9-13].

Subsequent studies extended accelerated delivery beyond two sessions per day. Three-session protocols showed outcomes comparable to standard rTMS within a shorter treatment window, while five-session protocols reported greater improvement with active accelerated rTMS compared to sham stimulation[14-16].

A important milestone for accelerated protocols was the development of highly intensive accelerated theta-burst protocols, particularly the Stanford Accelerated Intelligent Neuromodulation Therapy (SAINT) or also known as the Stanford Neuromodulation Therapy approach (SNT). This protocol used 10 Intermittent theta-burst stimulation (iTBS) sessions per day over 5 days and demonstrated feasibility in open-label work[17], followed by superiority of active treatment over sham in a randomized controlled trial[18]. Importantly, the SAINT/SNT protocol also incorporated proprietary personalized neuronavigation based on individualized functional connectivity MRI to optimize targeting of the left dorsolateral prefrontal cortex. This protocol became a reference point for modern highly concentrated aTMS paradigms.

More recent studies have evaluated intensive schedules of 3–10 sessions per day, reporting clinically meaningful reductions in depressive symptoms, acceptable tolerability, and no emergence

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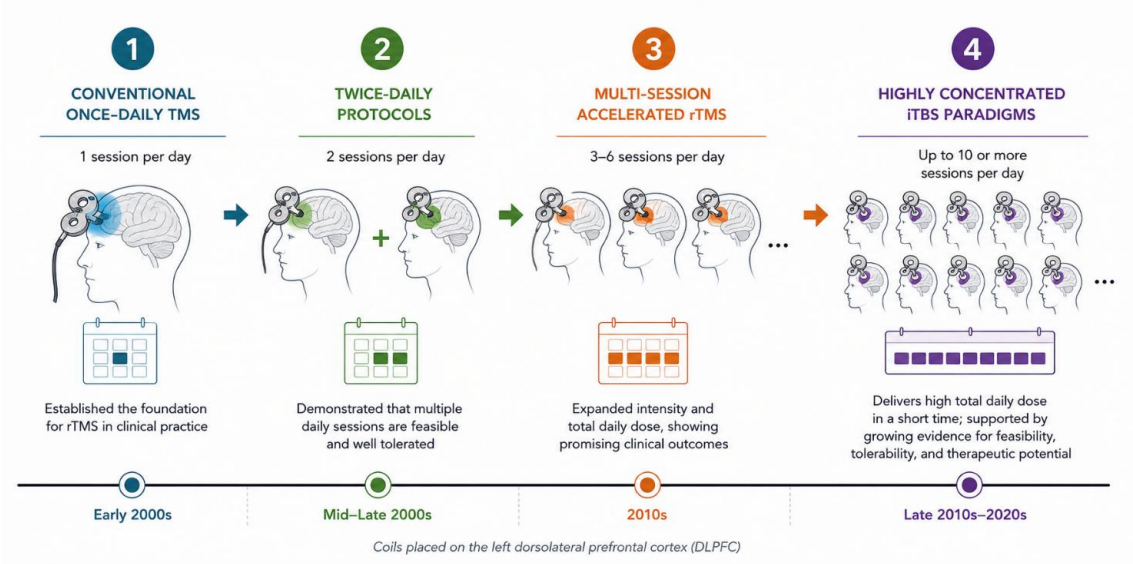
of new safety signals[19-23,53]. Overall, current high intensity aTMS regimens reflect two decades of systematic clinical development rather than isolated innovation.

This lineage demonstrates that current high intensity aTMS regimens are not isolated innovations, but the result of two decades of systematic clinical development, with accumulating evidence supporting feasibility, tolerability, and therapeutic potential (Figure 1).

*Figure 1: The evolution of accelerated TMS.*




## Scientific Rationale for Accelerated TMS

The scientific rationale for aTMS is that antidepressant efficacy may depend not only on target selection, but also on stimulation pattern, cumulative dose, and session spacing. iTBS is central to this model because it can induce plasticity-like effects in a much shorter treatment time than conventional high-frequency rTMS, making multiple sessions per day feasible[24,25]. Experimental studies further suggest that repeated iTBS sessions are not simply additive, and that inter-session spacing may influence the magnitude and durability of neuroplastic effects[26,27]. An additional component is circuit-based targeting, as antidepressant response has been associated with stimulation of left DLPFC sites functionally connected, particularly anticorrelated, with the subgenual anterior cingulate cortex[28,29].

Taken together, these findings support aTMS as a biologically plausible and clinically credible refinement of conventional TMS.

## Accelerated vs Conventional TMS

Standard TMS protocols (rTMS or iTBS) delivers one session per day over typically 4–6 weeks[30], whereas aTMS delivers multiple sessions per day (≥2), compressing the same or higher total treatment dose into days to 1–3 weeks (Table 1). Accelerated approaches include both accelerated rTMS (high-frequency protocols) and accelerated iTBS, with the key difference being the increased treatment density (sessions/day) rather than a change in fundamental mechanism.

*Table 1: Overview comparison of TMS paradigms*

| PARAMETER | 1 STANDARD rTMS | 2 STANDARD iTBS | 3 ACCELERATED rTMS | 4 ACCELERATED iTBS |
|---|---|---|---|---|
| Sessions per day | 1 | 1 | 2–5 | 2–10 |
| Total treatment duration | 4–6 weeks | 4–6 weeks | 2–3 weeks | 1–3 weeks |
| Total number of sessions | 20–30 | 20–30 | 20–50 (compressed) | 20–50+ |
| Pulses per session | 3,000 | 600 | 3,000 | 600–1,800 (protocol dependent) |
| Total pulse dose | 90,000 | 18,000 | 60,000–300,000+ | 90,000 |
| Efficacy | Established | Comparable to rTMS | Comparable or improved | Comparable or potentially higher (in some studies) |
| Safety/tolerability | Well established | Well established | Similar to standard | Similar; mostly mild, transient AEs |

## Clinical Evidence and Quantitative Outcomes

The accelerated TMS literature includes randomized trials, sham-controlled studies, open-label cohorts, and real-world retrospective analyses. Despite substantial heterogeneity in dosing, session frequency, and protocol design, three patterns are consistent: accelerated TMS can achieve outcomes like standard treatment, may shorten time to improvement in some protocols, and appears most promising when cumulative dose is high.

Randomized comparisons show comparable endpoint efficacy rather than clear superiority. Fitzgerald et al. (2018) reported identical outcomes for accelerated and standard rTMS, with response rates of 47% versus 46% and remission rates of 26% versus 24%[14]. Similarly, Blumberger et al. (2021) found no significant advantage for twice-daily over once-daily iTBS, with response rates around 41-44% and remission rates near 23%[13]. Finally, Ramos et al. (2025) demonstrated significantly higher response (54.7% vs. 31.9%) and remission (34% vs. 16%) rates versus sham with a three-times-daily iTBS protocol[23]. Some controlled studies suggest a faster antidepressant effect with accelerated treatment[16,18]. Still, not all sham-controlled studies have been positive, particularly when protocols used lower intensity or shorter duration. This suggests that accelerated delivery is unlikely to be effective unless paired with adequate overall dosing.

Open-label and naturalistic studies also report clinically meaningful improvements. McGirr et al. (2015) found response and remission rates of 55.6% and 37.0% after a two-week twice-daily course[9], while Massé-Leblanc et al. (2024) reported response in about 46% and remission in 36% in a larger retrospective sample)[31].

The most intensive accelerated paradigms have produced some of the strongest reported outcomes. Cole et al. (2022) evaluated an accelerated five-day protocol comprising 10 sessions per day and reported high immediate post-treatment outcomes, with response and remission rates of 71.4% and 57.1%, respectively [18]. These findings are clinically notable because they raise the possibility of rapid and substantial antidepressant effects in selected patients. Still, by the commonly used four-week endpoint, response decreased to 64.3% and remission to 42.9%, bringing the durability of benefit closer to outcomes typically reported with standard TMS treatment paradigms.

Apostol et al. (2026) evaluated a moderate-intensity accelerated "5 × 5" protocol consisting of five rTMS sessions per day over five consecutive days and compared outcomes retrospectively with conventional once-daily rTMS. Both approaches produced significant antidepressant improvement, with no statistically significant difference in overall symptom reduction after correction for multiple comparisons[53]. Importantly, the accelerated protocol produced substantially faster symptom improvement, while follow-up analyses suggested that some patients continued improving several weeks after treatment completion. These findings support the concept that clinically meaningful accelerated treatment effects may be achievable without ultra-high-intensity protocols.

## Protocol-to-Study Mapping

Table 2 provides an overview of representative aTMS treatment paradigms, illustrating the progression from moderately accelerated protocols (e.g., twice- or three-times daily sessions) to highly intensive regimens delivering multiple treatments per day. The table summarizes key protocol characteristics, including session frequency, treatment duration, and stimulation parameters, alongside corresponding clinical outcomes reported in the literature.

*Table 2: Overall paradigms of Accelerated TMS Protocols and Supporting Evidence*

| Protocol Type | Sessions/ Day | Total Duration | Pulses/ Session | Clinical Outcomes | Key Studies |
|---|---|---|---|---|---|
| **Twice-daily HF-rTMS** | 2 | 2–3 weeks | 1,600–3,000 | Response ~41–82%; remission ~25–65%; faster improvement vs once-daily | 9-11 |
| **Moderate accelerated rTMS** | 3 | 2–4 weeks | 3,000–3,500 | Comparable to standard rTMS; response ~47%, remission ~26% | 14 |
| **Moderate-high intensity accelerated rTMS** | 5 | 5 days | 1,800-3,000 | Comparable symptom reduction to conventional rTMS; rapid improvement; delayed continued response in some patients | 53 |
| **High-density accelerated rTMS** | 4–5 | ~1 week | 3,000 | Response ~50–60%; remission ~17–40%; with studies reporting earlier symptom improvement compared to baseline | 16,19 |
| **Accelerated iTBS (low–moderate intensity)** | 2–3 | 1–6 weeks | 600–1,800 | Response ~26–54%; remission ~23–34%; comparable to standard or superior to sham (in RCTs) | 13,15,23 |
| **Accelerated iTBS (high intensity)** | 4–5 | 4–10 days | 1,600–1,800 | Response ~28–38%; remission ~15–30%; some studies show superiority vs sham | 20,32 |
| **Ultra-/high-intensity aTMS** | 8–10 | ~5 days | 1,800 | High remission rates (up to >90% in open label including fcMRI-guided targeting); consistent superiority vs sham in RCTs; early effects | 17,18,21,22 |

## Practical experience with accelerated TMS protocols

In the Theta-burst Trial for Treatment-resistant depression (TTT trial; Ramos et al., JAMA Psychiatry 2025), we evaluated whether an accelerated iTBS protocol could improve outcomes within a markedly shortened treatment window in patients with treatment-resistant major depressive disorder (TRD). The trial was a single-center, double-blind, sham-controlled, parallel-group randomized clinical trial conducted at the Service of Interdisciplinary Neuromodulation, Institute of Psychiatry, University of São Paulo Medical School (Brazil). Seventy-five adults with TRD (failure of at least two adequate antidepressant trials in the current episode) were randomized 1:1 to active or sham accelerated iTBS, delivered with a MagPro R30 stimulator and a Cool-B70 A/P coil (MagVenture, Denmark).

The protocol delivered three iTBS sessions per day (1,800 pulses per session; 5,400 pulses/day; inter-session interval of approximately 30 minutes) over 10 consecutive weekdays, totaling 30 sessions and 54,000 pulses across two weeks. The left dorsolateral prefrontal cortex was targeted using the Beam F3 method at 120% of resting motor threshold. The primary outcome was the change in the 17-item Hamilton Depression Rating Scale (HAM-D-17) from baseline to week 4.

Active accelerated iTBS produced significantly greater HAM-D-17 reductions than sham, with response rates of 54.7% versus 31.9% and remission rates of 34.0% versus 16.0% at week 4. The intervention was well tolerated: the most frequent adverse event was transient scalp discomfort during the initial sessions, which attenuated with stimulus ramp-up, and no seizures or serious adverse events related to stimulation occurred. Blinding integrity, assessed at the end of treatment, was preserved, supporting the validity of the sham condition.

From an operational standpoint, several practical observations are worth highlighting. First, three sessions per day separated by 30-minute inter-session intervals proved logistically feasible for patients and staff and did not compromise tolerability. Second, scalp discomfort typically peaked on day 1 and diminished over subsequent sessions, an effect mitigated by gradual intensity ramp-up during the first day. Third, retention was excellent, with more than 95% of scheduled sessions completed; patients consistently described the compressed two-week schedule as more acceptable than a conventional six-week course, particularly those who had to travel or take time off work. Fourth, clinically meaningful antidepressant effects were obtained using standard scalp-based targeting (Beam F3), without individualized neuroimaging-based localization, supporting the feasibility of accelerated iTBS in real-world settings that lack advanced imaging infrastructure.

Two practical limitations should be acknowledged. The trial enrolled patients meeting standard TRD criteria but did not pre-select biomarker-defined subgroups, so individual response heterogeneity remained substantial; and long-term durability was not the primary focus of the study, leaving continuation strategies (for example, weekly maintenance iTBS or transition to once-daily protocols) as an open question for future work. Overall, the TTT trial supports accelerated iTBS, delivered with established stimulation parameters and conventional scalp-based targeting, as a clinically meaningful and operationally tractable option for patients with TRD.

## Safety Profile

Across the available literature, accelerated TMS appears to be safe and well tolerated, with a safety profile like standard once-daily TMS[33-36]. Larger review-level analyses have not identified an increased overall rate of serious adverse events with accelerated delivery.

In a transdiagnostic review covering 43,873 aTMS sessions, seizure incidence was reported as low and comparable to conventional rTMS, with one seizure reported overall corresponding to 0.0023% of aTMS sessions, compared with 0.0075% for once-daily rTMS. The most frequently reported side effects were acute headache (28.4%), fatigue (8.6%), and scalp discomfort (8.3%); all other side effects occurred at rates below 5% [35]. Ramping procedures may further improve tolerability.

The same general pattern is seen in accelerated iTBS-specific reviews, which describe favorable tolerability and no clear excess in discontinuation relative to sham or standard protocols [36-40].

## Targeting Approaches

Current evidence supports standard left-DLPFC targeting methods, e.g., 5.5-cm rule or Beam F3, as clinically appropriate for routine TMS practice. In the largest direct comparison, Morriss et al. (2024) evaluated connectivity-guided iTBS against structurally guided standard-site F3 rTMS in 255 patients with treatment-resistant depression[41]. Both groups showed sustained improvement over 26 weeks, with similar response and remission rates: 34.6% vs 30.4% response and 25.0% vs 20.6% remission for connectivity-guided versus standard-site targeting.

This is consistent with the broader synthesis by Terao and Kodama (2025), who reviewed randomized active-controlled trials and found that personalized targeting approaches, including fMRI-guided methods, had not shown a consistent clinical advantage over fixed or conventional targeting approaches such as Beam F3[42].

Imaging and connectivity studies are therefore better viewed as supporting biological plausibility and patient-selection research than as establishing a need for fcMRI-guided targeting in routine practice.

Cardenas et al. (2022) showed that Beam F3 and other head-size-adjusted methods were more precise and functionally appropriate than older fixed-distance methods, supporting Beam F3 as a reasonable modern standard approach[43]. Fitzgerald (2021) similarly concluded that Beam F3 provides reasonable localization, while fMRI-connectivity approaches remain promising but require stronger prospective clinical evidence[44].

## Evidence on iTBS Dosing

Some accelerated TMS protocols increase the number of pulses delivered per session or per day. However, recent once daily iTBS studies suggest that increasing pulse dose per session alone may not necessarily improve antidepressant outcomes. Kerkel et al. (2025) compared 600, 1,200, and 1,800 pulses per iTBS session over 15–20 treatment days, while Noda et al. (2025) evaluated real-world outcomes with 600 versus 1,200 pulses per session

[45,46]. In both studies, depressive symptoms improved significantly, but no statistically significant advantage was observed for higher pulse-dose regimens.

Their findings therefore suggest that, within once-daily iTBS protocols, pulse dose per session may be less clinically relevant than other dosing variables. In Noda et al. (2025), multivariate analyses further indicated that the number of treatment sessions, rather than pulse dose per session, was associated with greater clinical improvement [46].

For aTMS, response rates appear to increase with higher treatment intensity, including a greater number of sessions per day, a higher total number of sessions, and a larger cumulative pulse dose [35].

## Interval between sessions

Currently, the effect of the various parameters influencing the outcome of aTMS has not been evaluated systematically. Therefore, it is not possible to say anything definitively about the impact of intersessions intervals. The studies represented in Table 2 have reported intersession intervals (ISI) of 10–540 min (most used 15–50 min). No consistent differences in remission or side effects were seen between short and long ISIs. A standard ISI of 15–50 minutes is therefore supported by the literature.

## Clinical and Operational Considerations

The implementation of accelerated TMS requires adaptation of clinical workflows to accommodate multiple daily sessions. While this increases short-term scheduling complexity, the reduction in total treatment duration allows for improved patient throughput and more efficient use of clinical resources.

### Scalability

Accelerated TMS can typically be implemented with standard scalp-based targeting methods, such as Beam F3, which are already widely used in clinical practice. This supports integration into existing workflows without additional imaging infrastructure or major changes in technology or expertise[41,43, 53].

Neuronavigation may serve as a valuable adjunct in TMS practice by supporting operators in accurate target localization, optimizing clinical workflow, reducing potential sources of positioning error, and providing a visual, patient-facing tool that may enhance understanding and confidence in the treatment process.

Operationally, accelerated protocols require scheduling adaptations. This makes them a practical option for clinics seeking to increase flexibility, improve patient throughput, and deliver treatment within a shorter overall time while remaining aligned with current TMS practice standards.

The FDA-cleared flexible treatment paradigm further supports scalability by allowing treatment schedules to be adapted to patient needs, clinic capacity, staffing, and treatment intensity.

### Complexity of Imaging-Based Targeting

Connectivity-based (fcMRI-guided) targeting adds substantial operational complexity and cost, including fMRI acquisition, functional-connectivity processing, neuronavigation system, and specialized imaging expertise. Although mechanistic studies support the relevance of network-level targeting, comparative and large studies have not to-date shown a consistent clinical advantage over standard targeting in routine care [41,42]. As a result, the added cost, setup time, and infrastructure demands may limit adoption outside specialized or research-focused centers[41,42].

### Reimbursement for Accelerated TMS in the US

In the United States, reimbursement for accelerated TMS remains payer- and policy-specific. While standard TMS and iTBS are broadly reimbursed for appropriately selected patients with major depressive disorder, coverage frameworks were developed around conventional once-daily treatment schedules. As a result, accelerated protocols involving multiple sessions per day may be subject to additional utilization review, interpretation of session limits, or case-by-case medical necessity assessment depending on the payer and treatment design.

Medicare coverage for accelerated TMS currently remains tied to broader regional Medicare coverage policies for TMS rather than to dedicated accelerated-TMS reimbursement pathways. CMS has not issued a national coverage determination specific to accelerated TMS, and coverage decisions are instead administered through regional Medicare Administrative Contractor (MAC) local coverage determinations (LCDs). Existing LCDs generally support reimbursement for medically necessary TMS in appropriately selected patients with major depressive disorder, but they do not consistently address high-intensity accelerated protocols, SAINT/SNT-type paradigms, or neuroimaging-guided accelerated treatment specifically. As a result, reimbursement for accelerated schedules may depend on local MAC interpretation, documentation of medical necessity, coding practices, and utilization review.

For commercial payers, coverage appears to be evolving. Internal payer tracking identifies examples of insurers or policies that may cover certain accelerated treatment approaches, including Blue Cross Blue Shield Texas, Premera Blue Cross Blue Shield, Independence Blue Cross in Pennsylvania, and Highmark's SWIFT-related coverage, while some policies specifically exclude SAINT and/or neuroimaging-based components. This suggests that accelerated TMS may increasingly be considered under existing TMS benefit structures, but coverage should be verified case by case because payer policies may distinguish between standard TMS, iTBS, and other accelerated protocols, some of which may use neuroimaging-guided targeting.

Overall, reimbursement remains an important implementation constraint for accelerated TMS. Clinics considering accelerated protocols should confirm payer-specific medical policies, prior authorization requirements, allowable CPT coding, session-frequency rules, and any exclusions related to accelerated schedules or imaging-based targeting before treatment initiation.

## Durability of Treatment Effects

An important and still unresolved question is whether accelerated TMS protocols affect the durability of antidepressant response. Current evidence does not indicate that accelerated approaches are inherently less durable than standard TMS; however, the data remain mixed and highly dependent on protocol design[40].

Durability, defined as persistence of antidepressant effects over time, appears broadly comparable to standard TMS in some datasets, including meta-analytic evidence and real-world accelerated TMS data, but interpretation is limited by short follow-up, protocol heterogeneity, and the predominance of small or open-label studies[47,48].

A key consideration emerging from current literature is the distinction between time compression and total neurostimulation dose. When accelerated protocols deliver a total pulse dose that matches or exceeds standard courses, durability tends to be maintained. In contrast, protocols that compress treatment into a shorter period without sufficient cumulative dose may show earlier symptom recurrence. This aligns with broader rTMS evidence suggesting that total stimulation dose and number of sessions are associated with clinical outcomes[4,40].

In clinical practice, a common pattern is that accelerated protocols can produce earlier remission compared to baseline, but some patients may experience earlier relapse if no continuation strategy is implemented. As a result, many accelerated approaches are paired with maintenance TMS, such as weekly tapering or transition into standard-frequency continuation treatment.

Apostol et al. (2026) further observed that some patients receiving a 5 × 5 accelerated protocol showed limited benefit immediately after treatment completion but demonstrated clinically meaningful improvement at two-to-four-week follow-up[53]. These findings suggest that assessment of accelerated TMS outcomes immediately after treatment may underestimate eventual antidepressant benefit in some patients.

## Key open questions

### Dose vs Targeting

The relative contribution of stimulation dose, number of sessions, session spacing, and targeting method remains unclear. Recent iTBS dosing studies suggest that increasing pulses per session alone does not necessarily produce greater antidepressant effects, while the overall treatment course may be more relevant[45,46]. At the same time, targeting studies support the biological relevance of DLPFC network engagement, but have not established that advanced imaging-based targeting is required for meaningful clinical response [41,49].

Similarly, Apostol et al. (2026) reported clinically meaningful outcomes using a less intensive accelerated 5 × 5 paradigm compared with more concentrated accelerated protocols described elsewhere in the literature[53]. These findings raise the possibility that total session number and treatment timing may be more clinically relevant than maximal acute stimulation density alone.

### Durability of Response

A key question is whether faster treatment delivery changes the durability of clinical benefit. Accelerated protocols may reduce the time to treatment completion and may improve access, but more evidence is needed on relapse rates, maintenance strategies, retreatment schedules, and whether outcomes remain stable beyond the acute follow-up period.

### Personalization/ Advanced Targeting

Personalized connectivity-based targeting may become more feasible through centralized image processing, cloud-based targeting algorithms, and simplified neuronavigation workflows. However, the cost-effectiveness, clinical added value, and practical integration of these models into routine psychiatric practice remain to be established. For now, standard targeting remains the most scalable approach, while advanced targeting continues to evolve as a potential personalization tool.

## Future Directions

Further research is needed to optimize aTMS protocols, including determination of optimal session spacing, total pulse dose, and treatment duration. Personalization of treatment through biomarker-guided targeting and dosing represents a promising avenue for improving outcomes.

Comparative studies evaluating accelerated TMS against other treatment modalities, such as electroconvulsive therapy and ketamine, will be critical for defining its role in the treatment landscape. Additionally, long-term outcome data and health economic analyses will be essential to support broader adoption.

Another promising option for the treatment of depression is magnetic seizure therapy (MST), which offers a potential alternative to electroconvulsive therapy (ECT) for severely depressed patients with fewer cognitive side effects[50,51].

### Ongoing and Planned Accelerated TMS Clinical Trials

A review of registered studies on ClinicalTrials.gov demonstrates continued and expanding interest in aTMS protocols across a broad range of neuropsychiatric indications. The identified studies include interventional trials evaluating accelerated TMS paradigms in MDD, post-traumatic stress disorder (PTSD), substance use disorders, neurological disorders, and other neuropsychiatric conditions. Most studies are designed as prospective interventional trials, with several incorporating sham-control conditions and advanced targeting methodologies.

Depression-related studies represent the largest subgroup of ongoing accelerated TMS research. These include trials investigating accelerated TMS for treatment-resistant depression, perinatal depression, and imaging-guided accelerated TMS approaches. Likewise, Studies continue to examine whether improved outcomes with aTMS for depression depend on the dose and treatment schedule, or on MRI-based targeting.

Accelerated TMS is also being explored in neurological disorders such as focal hand dystonia, cervical dystonia, stroke-related apathy, seizure-type functional neurological disorders, and alcohol use disorder. Additional studies investigate accelerated TMS for nicotine dependence and smoking cessation, highlighting the broader application of accelerated stimulation paradigms beyond mood disorders.

The reviewed studies additionally demonstrate considerable methodological diversity, including variations in stimulation frequency, pulse dose, number of daily sessions, treatment duration, targeting strategy, and sham methodology.

Another emerging approach combines an ultra-accelerated protocol of up to 20 TMS sessions in a single day with pharmacological augmentation, such as D-cycloserine, to

potentially enhance neuroplasticity and neuronal response. Early studies have reported promising results, but this approach remains experimental and requires validation in larger sham-controlled trials[52].

Overall, the current clinical trial landscape indicates that accelerated TMS represents an active and rapidly evolving area of neuromodulation research. The large number of ongoing and planned studies reflects substantial clinical and scientific interest in determining whether accelerated delivery paradigms can improve treatment accessibility, shorten time to response, and expand therapeutic applications across psychiatric and neurological disorders.

## Conclusion

Accelerated TMS represents a structured evolution of established TMS paradigms, enabling delivery of treatment within a condensed period through multiple daily sessions. The current body of evidence, including randomized controlled trials, observational studies, and real-world data, demonstrates that accelerated protocols achieve antidepressant outcomes comparable to standard once-daily TMS, with similar safety and tolerability profiles.

Accelerated TMS approaches have shown the potential to produce more rapid symptom improvement compared with conventional treatment schedules, although this potential advantage has not yet been firmly established. Reported benefits are influenced by multiple interacting factors, including total stimulation dose, number of sessions, inter-session spacing, and targeting approach, all of which remain areas of active investigation.

From a clinical and operational perspective, accelerated TMS offers a time-compressed alternative that may improve treatment accessibility and flexibility for both patients and providers. However, its implementation requires consideration of workflow, patient selection, and reimbursement constraints.

Overall, accelerated TMS should be understood as a pragmatic extension of existing TMS practice, rather than a replacement, with the potential to expand how and when treatment is delivered while maintaining established standards of safety and effectiveness.

Continued research, particularly well-controlled comparative studies and long-term outcome data, will be essential to define its optimal role in clinical care.

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