RESEARCH SUMMARY BRIEF

THE MATRIX MODEL FOR THE TREATMENT OF STIMULANT USE DISORDERS

The Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM–5TR) defines stimulant use disorder as "a pattern of amphetamine-type substance, cocaine, or other stimulant use leading to clinically significant impairment or distress" (American Psychiatric Association [APA], 2022). According to the 2021 National Survey on Drug Use and Health (NSDUH), 1.6 million people over the age of 12 had methamphetamine use disorder, 1.4 million people had cocaine use disorder, and 1.5 million people had prescription stimulant use disorder in the U.S. (Substance Abuse and Mental Health Services Administration [SAMHSA], 2022). The latest data from the NSDUH show that the prevalence of methamphetamine use in Ohio had a sharper increase (83%) than the United States (9%) from the period of 2017-2018 to 2018-2019. The prevalence of cocaine use in Ohio showed an increase of 8% for the same period, whereas there was a 5% decrease in the United States during that timeframe.

The Matrix Model was developed at the Matrix Institute in the 1980s as a response to the cocaine epidemic. It stands out as one of the few treatment models designed to address the treatment needs of individuals with stimulant use disorders. This brief outlines findings from a review of the research literature focused on the effectiveness and utility of the Matrix Model.

Matrix Model Components

In 2006, the SAMHSA Center for Substance Abuse Treatment (CSAT) published manuals for the Matrix Model. While other versions of the model have been developed over time, none of the updated models have been made publicly available. The CSAT version of the Matrix Model generally includes three individual or conjoint sessions, eight early recovery skills group sessions, 32 relapse prevention group sessions, 12 family education sessions, and 36 social support sessions. Clients are also encouraged to attend 12-step programs or other support groups (CSAT, 2006).

Literature Review Methods

In 2023, a literature review was conducted to investigate outcomes associated with the Matrix Model. The literature review included searching multiple research databases: PsycINFO, MEDLINE, SocINDEX, Psychology and Behavioral Sciences Collection, and Cochrane Library. Twenty-one articles met eligibility criteria for a full review. Of these, nine studies were experimental[1], four studies were quasi-experimental[2], and eight were non-experimental[3]. Ten studies were conducted in the U.S., nine in Iran, one in Thailand, and one in South Africa. Table 1 outlines the reviewed studies.

Table 1. Description of Reviewed Matrix Model Studies (Total n=21)

Outcomes	Retention/attendance (n=9) Treatment completion (n=5) Abstinence/relapse (n=14) Functioning (n=11) Craving (n=7) Treatment process factors (n=1) Program attributes (n=1) Risky behaviors (n=1) Physiological outcomes (n=1) Cognitive performance (n=1)
Drug use type(s)	Methamphetamine (n=11) Cocaine (n=4) Methamphetamine vs. cocaine (n=2) Stimulant (n=2) Amphetamine (n=1) Methamphetamine vs. opioid (n=1)

Findings

Overall, the findings on the effectiveness of the Matrix Model compared to another type of treatment are mixed. There is strong support for improved outcomes

[1] participants randomly assigned to either the Matrix Model or another form of treatment, or to no treatment

[2] involves at least two treatment groups/conditions, but does not include random assignment

[3] lacks random assignment of participants to study conditions and often evaluates a single treatment group (i.e., the Matrix Model)

related to drug use and cravings when the Matrix Model is combined with pharmacotherapy and brain stimulation. Other studies of the Matrix Model demonstrated that abstinence or reductions in drug use were associated with baseline drug use severity (i.e., higher severity was associated with reduced drug use at follow-up), in-treatment abstinence, and increased session attendance.

Retention, attendance, and treatment completion: Studies often measured retention, attendance, and completion using the average number of sessions clients attended. While one study found no difference in retention between the Matrix Model and a less intense form of treatment (Rosenblum et al., 1999), another study showed that the Matrix Model enhanced retention outcomes compared to "treatment-as-usual" (TAU) (Rawson et al., 2004). One study showed that retention outcomes could be improved by combining the Matrix Model with drug court models (Marinelli-Casey et al., 2008). Retention in Matrix Model treatment appeared to vary by participant drug of choice, type of treatment setting, and socioeconomic status. Overall, the Matrix Model appeared to have some promise for enhancing retention, attendance, and treatment completion outcomes.

Abstinence/relapse: Drug use outcome measures included reductions in drug use, abstinence, and relapse outcomes. Some studies pointed to the importance of client abstinence (lasting at least three weeks) during treatment and longer treatment episodes in achieving subsequent abstinence or decreased drug use over time (Marinelli-Casey et al., 2008; Rawson et al., 2012). Providing psychopharmacological or other medical or psychosocial interventions in conjunction with the Matrix Model had the potential for achieving desired drug use-related outcomes. Studies suggested that the Matrix Model had promise for improving stimulant use outcomes.

Functioning: Several studies measured different types of functioning outcomes, including addiction severity, depressive symptoms, and anxiety symptoms. Studies provided support for the effectiveness of the Matrix Model in improving quality of life, functioning in the legal, employment, medical, psychological, family and alcohol domains of the ASI. Matrix Model treatment was also associated with decreased depressive and anxiety symptoms. According to a few comparative studies (Rawson et al., 1995; Rawson et al., 2004), the Matrix Model did not improve functioning outcomes better than other forms of treatment. A few studies demonstrated that augmenting the Matrix Model with another form of treatment (e.g., methyphenidate or oxytocin) may enhance outcomes, such as mental health symptoms (Aryan et al., 2020; Azadbakht et al., 2022).

Craving: Craving outcomes were defined as desire to use methamphetamines or cocaine. Studies showed strong support for add-on pharmacological interventions in reducing craving (Aryan et al., 2020; Azadbakht et al., 2022; Salehi et al., 2015). However, it was difficult to draw clear conclusions about which medications should be used in conjunction with the Matrix Model because the types of medication used varied across studies.

Treatment process and program attributes: In one Thailand-based study, *yaba* (methamphetamine mixed with caffeine) users rated treatment process and program attribute outcomes for the Matrix Model compared to an inpatient treatment program (Perngparn et al., 2011). For the inpatient program, treatment process (e.g., participation in treatment) and program attribute (e.g., peer support, counselor attitudes) ratings improved between the 1.5- and 3-month period. Ratings for the Matrix Model did not change significantly over that timeframe.

Risky behaviors: Rawson et al. (2008) used secondary data to examine risky behaviors, including high-risk sexual behaviors and injection practices among methamphetamine users receiving Matrix Model treatment or TAU. No significant differences were found between the Matrix Model and TAU groups. However, the combined sample had reductions in risky sexual behaviors and injection behaviors from baseline to treatment discharge. Those who stayed in treatment longer had larger reductions in risky sexual and injection behaviors.

Physiological outcomes: One study examined the effect of oxytocin on two stress hormones (Adrenocorticotropic hormone [ACTH] and cortisol) for a Matrix Model plus placebo group and a Matrix Model plus oxytocin group (Azadbakht et al., 2022).

The Matrix Model plus oxytocin group had significant decreases in cortisol levels at the end of the trial and four weeks after the treatment, as well as decreased ACTH at the end of treatment.

Cognitive performance: One study employed measures of cognitive performance tests to evaluate the effectiveness of transcranial direct current stimulation (tDCS) on cognitive performance measures, such as visual and auditory memory (Fayaz Feyzi et al., 2022). In a comparison of Matrix Model plus active tDCS, Matrix Model plus sham tDCS, and Matrix Model only, significant gains in cognitive performance were only detected for the Matrix Model plus active tDCS group.

Limitations

In 2018, the Matrix Institute merged with CLARE Foundation under a new name - CLARE|MATRIX. According to CLARE|MATRIX leadership, the 2006 CSAT version of the Matrix Model is considered outdated. As a premier source of information on the Matrix Model, CLARE|MATRIX uses and provides training on a newer, revised version of the model that integrates motivational interviewing, cognitive-behavioral techniques, and contingency management, while retaining twelve-step facilitation (TSF) and family involvement (CLARE|MATRIX, 2023). No research has been published on the revised CLARE|MATRIX models.

Conclusion

Based on published peer-reviewed literature to date, the Matrix Model is a promising multi-component treatment model with mixed evidence of treatment effectiveness depending on the type of outcome studied and treatment augmentation variations. Furthermore, two evidence-based practice (EBP) registries rated the Matrix Model at the midpoint of their respective rating systems, indicating some support for the effectiveness of the model.

As is often seen in the development and progression of evidence-based interventions, there are now at least two additional variations of the Matrix Model - one for criminal justice settings and one for teens and young adults. As the Matrix Model has evolved over the past 30 years, research publications have not examined the most recent iterations to evaluate current treatment effectiveness. Supporting additional research and evaluation on more recent versions and diverse applications of the Matrix Model would help close that gap.

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