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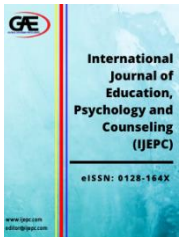


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# METHAMPHETAMINE ABUSE IN MALAYSIA: A NARRATIVE REVIEW OF EPIDEMIOLOGY, HEALTH CONSEQUENCES, AND INTERVENTION STRATEGIES

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**Abstract:**

Methamphetamine abuse remains a pressing global public health challenge, with many countries—including Malaysia—continuing to grapple with its multifaceted social and economic repercussions. Despite the implementation of rigorous drug control policies and extensive rehabilitation programmes, methamphetamine addiction continues to pose significant risks to individuals,

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families, and the broader community. This narrative review synthesises contemporary evidence on methamphetamine misuse in Malaysia by drawing on a range of studies from local and international sources. The review addresses the epidemiological patterns of use, discusses the psychosocial and neurobiological mechanisms underlying methamphetamine addiction, and highlights the detrimental health impacts linked to chronic use. Special attention is directed towards behavioural and pharmacological intervention strategies, including the current status of pharmacotherapy research for methamphetamine use disorder (MUD). While non-pharmacological methods—such as cognitive-behavioural therapy and contingency management—have demonstrated varying degrees of efficacy, the limited progress in pharmacological options underscores the complexity of treating methamphetamine addiction. By consolidating insights from existing research, the review aims to inform policy-makers, healthcare professionals, and community stakeholders of the urgency to develop evidence-based, tailored solutions that address the dynamic needs of individuals who misuse methamphetamine in Malaysia.

**Keywords:**

Methamphetamine Abuse, Neurotoxicity, Pharmacological Interventions Substance Use Disorder

## Introduction

Drug addiction endures as one of the world's gravest social and public health problems, resisting the efforts of multiple prevention and remediation strategies over the decades (World Health Organization [WHO], 2020). Numerous types of substances—ranging from licit medications to illicit drugs—continue to be widely misused, with persistent adverse effects on individuals' health, social stability, and economic productivity. Within Malaysia, the issue of drug misuse has attracted considerable attention, as policy-makers and law enforcement agencies attempt to curb the proliferation of controlled substances while simultaneously providing treatment avenues for those suffering from substance use disorders (Mohd Nawawi et al., 2024).

Evidence suggests that a broad spectrum of narcotics is misused in Malaysia, with relatively recent research pointing to an upsurge in methamphetamine abuse (Fook & Adnan, 2020). According to data from the National Anti-Drug Agency (NADA), opiates and amphetamine-type stimulants (ATS) remain among the most commonly misused substances in the country, thus corroborating global trends of rising stimulant misuse (Mohd Nawawi et al., 2024). Additionally, the Statista Research Department (2022) identifies crystal methamphetamine, colloquially referred to as "syabu," as the most frequently abused drug in Malaysia. This problem is particularly pronounced among young adults (i.e., those aged 19 to 39), comprising nearly 59.6% of documented drug users between January and March 2023, followed by older adults aged 40 years and above (39.9%) and, to a lesser yet alarming extent, minors (13 to 18 years old), representing 0.4% of registered users (Mohd Nawawi et al., 2024).

Several psychosocial variables contribute to the susceptibility of Malaysian youth to methamphetamine abuse and other forms of substance misuse. These include academic stress, poor relationships with parents or guardians, and antisocial environments that encourage involvement in gangs, violence, or petty crime (Alhammad et al., 2022; Ismail et al., 2023).

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Among adults, high-pressure workplaces, financial instability, and personal stressors frequently serve as catalysts for substance misuse (Li et al., 2021). While many users initially experience euphoria and heightened alertness, methamphetamine addiction rapidly degenerates into severe health complications, diminished social functioning, and significant economic strain (Audi et al., 2023).

This review aims to explore the multifaceted dimensions of methamphetamine misuse in Malaysia, spanning epidemiology, physiological and psychosocial impacts, as well as existing interventions and future treatment prospects. By synthesising relevant literature, this paper identifies core challenges and knowledge gaps requiring further investigation. In doing so, it supports the development of more refined, evidence-based policy measures and comprehensive treatment protocols that can mitigate the growing prevalence of methamphetamine misuse in Malaysia.

## Methods

This review employed a systematic literature search strategy to identify relevant research on methamphetamine misuse in Malaysia. The following databases were consulted: PubMed, Scopus, Web of Science, and Google Scholar. Keywords and phrases used in the search included "methamphetamine," "crystal meth," "syabu," "Malaysia," "drug abuse," "substance use disorder," "neurotoxicity," "treatment," and "intervention."

The inclusion criteria for studies were as follows: (1) original research articles, (2) published in English, (3) focused on methamphetamine misuse in Malaysia, and (4) provided empirical data on prevalence, risk factors, consequences, or interventions. Exclusion criteria included case reports, editorials, and studies that did not directly address methamphetamine misuse in Malaysia.

The identified studies were critically appraised to assess their methodological quality and relevance to the research questions. The appraisal process considered factors such as study design, sample size, data collection methods, statistical analysis, and the clarity of reporting.

A thematic analysis approach was adopted to synthesize the findings from the included studies. Key themes were identified based on the research questions and the emerging patterns in the literature. These themes were then further explored and elaborated upon, drawing on the specific findings of the individual studies.

## Literature Review and Synthesis

Extensive research highlights the multifactorial nature of methamphetamine misuse, integrating physiological, psychological, and social dimensions. The diverse literature can be summarised under the following thematic areas.

### *Classification and Mechanism of Action*

Methamphetamine is a potent central nervous system (CNS) stimulant that significantly alters monoaminergic transmission by increasing the levels of dopamine, norepinephrine, and serotonin in the synaptic cleft (Der-Ghazarian et al., 2019). These heightened neurotransmitter levels stem largely from methamphetamine's capacity to reverse the normal function of transporters, thereby promoting the excessive release of dopamine and other monoamines, while concurrently inhibiting their reuptake (Miner et al., 2019). In some cellular models,

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methamphetamine has been demonstrated to interfere with trace amine-associated receptor 1 (TAAR1), culminating in compromised dopamine signalling (Shi et al., 2019).

Chronic exposure to methamphetamine may precipitate substantial neurotoxic consequences, particularly in dopaminergic and serotonergic pathways (Nash & Yamamoto, 1992; Orikabe et al., 2011). Researchers have documented that methamphetamine fosters neurite degeneration by facilitating dopamine release into the cytoplasm, leading to an escalation in reactive oxygen species (ROS) and resultant oxidative stress. Neuroimaging investigations provide extensive corroboration: Sarnyai et al. (2014) observed abnormal grey-matter depletion in the cingulate, limbic, and paralimbic cortices among methamphetamine-dependent subjects, while Carson et al. (2010) identified structural deficits in the cerebellum, specifically in its molecular and granular layers. These discoveries underscore the severe long-term neurological impairments that can emerge from regular methamphetamine use.

***Prevalence and Socioeconomic Consequences***

Despite rigorous legislative frameworks aimed at constraining drug misuse in Malaysia, methamphetamine abuse persists, reflecting a broader global challenge wherein users are drawn to the immediate psychoactive effects of stimulants (Jones et al., 2020). Government agencies, including NADA, frequently report rising misuse trends. Moreover, the COVID-19 pandemic and related movement control orders inadvertently amplified vulnerability for certain populations, as many individuals experienced job losses, social isolation, and mental distress (Rodriguez et al., 2020; Kim et al., 2020).

Recent findings indicate that around 62% of incarcerated individuals or clients in rehabilitation settings allocate RM100 per day to purchasing illicit substances (Ibrahim et al., 2021). Such expenditures can result in serious financial strains on the families of those who misuse drugs, especially those within the lower socio-economic segment, commonly referred to as the B40 group in Malaysia. Consequently, the compulsion to sustain methamphetamine use often drives individuals to engage in property crimes, theft, or robbery (Langfield & Payne, 2020). This pattern of criminality not only undermines family and community well-being but also significantly burdens the national criminal justice system.

***Aggression, Cognitive Impairment, and Mental Health***

Methamphetamine misuse carries a well-documented association with aggressive tendencies and increased propensity toward violence, likely rooted in drug-induced neurobiological transformations that intensify impulsivity (Brecht & Herbeck, 2013; Khizar et al., 2021). Among methamphetamine users, there is also a heightened prevalence of psychosis and mood disturbances, including paranoia, hallucinations, and depressive symptoms (Hashisha et al., 2022). Disruptions to dopamine homeostasis, coupled with structural damage in frontal and limbic regions, compromise key functions such as decision-making, impulse control, and emotional regulation (Nordahl et al., 2003; ČECHOVÁ & ŠLAMBEROVÁ, 2021).

Another aspect of health deterioration relates to the phenomenon of abnormal ageing and facial asymmetry, as noted by Harastani et al. (2020). In addition to characteristic hallmarks like “meth mouth,” persistent nosebleeds, and noticeable skin lesions, facial symmetry often deteriorates at a rate well above what might be expected from natural ageing. This phenomenon complicates forensic and biometric assessments, simultaneously spotlighting the broader

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physical toll that chronic methamphetamine misuse exacts on the human body (Harastani et al., 2020).

## *Current Issues Surrounding Methamphetamine Misuse*

### *Government Responses and Rising Trends*

Malaysia has instituted rigorous drug laws, including capital punishment for the trafficking of considerable amounts of certain narcotics. Despite these punitive measures, methamphetamine-related offences have remained alarmingly prevalent (UNODC, 2022). One reason often cited is the profitability of the trade itself, propelled by continued market demand. Moreover, the illicit drug economy operates through clandestine networks that adapt swiftly to governmental crackdowns, shifting distribution routes and employing sophisticated concealment methods.

The COVID-19 era compounded challenges: newly unemployed or underemployed individuals were driven by desperation to alternative and often illegal means of income, while users found themselves with heightened stress and fewer avenues of support due to social distancing mandates (Rodriguez et al., 2020; Ibrahim et al., 2021). During these lockdown periods, rates of substance misuse—including methamphetamine—are thought to have escalated in certain communities, especially when standard mental health services and in-person group support programmes were either inaccessible or severely limited (Kim et al., 2020).

### *Methamphetamine's Health Impacts*

Methamphetamine's deleterious effects span both physical and psychological domains. In a detailed comparative analysis, Harastani et al. (2020) reported a marked increase in facial asymmetry—by as much as 5% in geometric terms and 11% in textural terms—among methamphetamine users. This abnormal ageing trajectory further manifests in a suite of health complications, including severe dental decay, sores on the skin from frequent picking, and pronounced weight loss that degrades physical appearance. Alongside these visible transformations, many users also exhibit acute or chronic manifestations of confusion, aggression, and sensory hallucinations, as well as higher incidences of mood disorders such as anxiety and depression (Hashisha et al., 2022).

Adding to the concern, studies focusing on adolescents and young adults document strong correlations between methamphetamine use and antisocial tendencies (Kaye et al., 2020). Compared to cannabis users, methamphetamine users tend to display more pronounced aggression and impulsivity (Khizar et al., 2021). Collectively, these findings reinforce the assertion that methamphetamine's influence extends well beyond neurochemical disruptions, exerting a deep and pervasive impact on personality, social interactions, and overall public health.

### *Physiological and Neurological Damage*

A robust body of evidence ties methamphetamine to grave neurotoxic consequences (Nash & Yamamoto, 1992; Orikabe et al., 2011). Prolonged usage facilitates oxidative stress, leading to damage in dopaminergic, serotonergic, and noradrenergic pathways (Nordahl et al., 2003). Cognitive impairment, memory loss, and severe mood dysregulation can ensue, paired with documented morphological changes such as grey-matter depletion and structural atrophy in the cerebellum (Carson et al., 2010; Sarnyai et al., 2014).

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#### *Psychosocial Consequences*

The social ramifications of methamphetamine misuse are similarly profound. Individuals grappling with methamphetamine dependence frequently report deteriorating family relationships, financial instabilities, and increased susceptibility to criminal activities (Langfield & Payne, 2020; Ibrahim et al., 2021). Moreover, heightened aggression and impulsivity further strain the social fabric, manifesting in violence and endangering community safety (Brecht & Herbeck, 2013; Khizar et al., 2021).

### *Interventions and Treatment Efficacy*

Multiple evidence-based psychosocial interventions, such as cognitive-behavioural therapy (CBT), contingency management (CM), motivational interviewing, and the Matrix Model, have been trialled for methamphetamine addiction (Siefried et al., 2020; Moszczynska, 2021). Although some interventions exhibit promise in fostering abstinence and reducing relapse rates, no single approach demonstrates universal success, partially due to the heterogeneity of individuals affected by methamphetamine use disorder (MUD). Equally notable is the absence of a pharmacological "gold standard." While some drugs show preliminary benefits, low sample sizes, high drop-out rates, and methodological limitations hinder definitive conclusions (Ballester et al., 2016; Davis & Carter, 2023).

Although methamphetamine addiction is challenging to manage due to its long-lasting impact on brain function, several intervention strategies have shown potential. These interventions broadly fall into non-pharmacological and pharmacological approaches.

### *Non-Pharmacological Treatments*

#### *Cognitive-Behavioural Therapy (CBT)*

CBT remains a cornerstone of substance use disorder interventions, grounded in the principle that maladaptive thought processes and coping mechanisms catalyse addictive behaviours. In CBT sessions, individuals learn to identify dysfunctional beliefs—such as a perceived inability to function or feel pleasure without methamphetamine—and to replace them with more adaptive, reality-based cognitions (McHugh et al., 2010). Behavioural components focus on the acquisition of practical skills, including relapse prevention strategies, refusal techniques, and the restructuring of daily routines to eliminate high-risk triggers (Moszczynska, 2021).

#### *Contingency Management (CM)*

Contingency management is built upon B.F. Skinner's principles of operant conditioning, emphasising tangible rewards for desired behaviours. Methamphetamine users who provide drug-free urine samples may receive vouchers or other forms of positive reinforcement (Okafor et al., 2020 as cited in Moszczynska, 2021). This association helps align the user's motivational system—particularly dopaminergic reward pathways—with abstinence, thus theoretically alleviating the compulsion to seek further drug use (Moszczynska, 2021).

#### *The Matrix Model Therapy*

The Matrix Model is an integrative framework that merges various evidence-based techniques, including motivational interviewing, cognitive-behavioural strategies, relapse prevention methods, family education, and 12-step facilitation (AshaRani et al., 2020 as cited in Moszczynska, 2021). Sessions often comprise intensive outpatient treatment, focusing on modifying neuroplasticity in key brain regions such as the prefrontal cortex, the nucleus

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accumbens, and the amygdala. By reinforcing healthier responses to stress and cravings, the Matrix Model shows encouraging outcomes in terms of short-term retention and reduced methamphetamine intake (Moszczynska, 2021).

#### *Twelve-Step Facilitation Therapy*

Twelve-step facilitation therapy aligns with the core spiritual and communal principles of mutual-help groups, including Alcoholics Anonymous (AA) or Narcotics Anonymous (NA). These programmes advocate acceptance, self-reflection, and an active commitment to abstinence, supported by peer networks and shared lived experiences (Moszczynska, 2021). Participation in 12-step groups can offer social reinforcement while also providing an alternative reward pathway through community support, which is particularly important for individuals struggling with isolation or prolonged substance dependency (Amiri et al., 2016 as cited in Moszczynska, 2021).

### *Pharmacological Interventions*

Despite the relative success of behavioural strategies, an ideal pharmacological agent to treat methamphetamine use disorder remains elusive. Numerous researchers have tested various classes of medications, yet robust, large-scale clinical evidence is sparse (Siefried et al., 2020; Davis & Carter, 2023). Key developments include:

#### *Dopamine Agonists*

Modelled on existing treatments for opioid dependence (e.g., methadone, buprenorphine), the use of safer, less euphoric dopamine agonists could, in theory, mitigate methamphetamine cravings by stabilising dopaminergic signalling. Although some early-phase clinical trials appear somewhat encouraging, the studies are generally underpowered or limited by high attrition rates (Ballester et al., 2016).

#### *Medications Targeting Norepinephrine and Dopamine*

Certain agents that inhibit norepinephrine and dopamine reuptake have been explored for their potential to reduce methamphetamine cravings and improve executive functioning. While some improvement has been observed in craving reduction, definitive evidence of efficacy and safety is lacking (Ballester et al., 2016).

#### *Opioid System Modulators*

Owing to evidence that the opioid system mediates certain euphoric and rewarding effects of drug use, trials of naltrexone and other opioid antagonists have been undertaken to ascertain their utility in methamphetamine dependence. Results, however, remain mixed (Ballester et al., 2016).

#### *Immunotherapy (Vaccine) Approaches*

Vaccine-based strategies involve prompting the body to form antibodies that bind to methamphetamine, thus preventing it from crossing the blood-brain barrier. While this is a novel approach with potential long-term implications, the primary challenges include the variability in individual immune responses, the time required to generate effective antibody levels, and the potential for users to simply ingest higher drug doses to override the antibody response (Ballester et al., 2016).

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### *GABA-Related Medications*

Emerging findings indicate that certain gamma-aminobutyric acid (GABA) modulators—such as topiramate—might aid in reducing methamphetamine cravings and easing withdrawal symptoms. Nevertheless, these results require replication in larger clinical trials to verify their broader applicability (Siefried et al., 2020).

## Implications for Future Research and Practice

The evolving landscape of methamphetamine misuse necessitates multifaceted and adaptable responses. While significant progress has been made in delineating the neurobiological underpinnings of methamphetamine addiction, substantial knowledge gaps remain in the areas of treatment matching, relapse prevention, and pharmacotherapy development. Among the more pressing needs are:

### *Combination Treatments*

There is an increasing call for research designs that compare psychosocial interventions (e.g., CBT, CM) combined with medication against medication alone. Such comparisons will provide greater insight into whether integrated approaches yield superior outcomes across diverse demographic and clinical profiles (Siefried et al., 2020).

### *Client-Centred Care*

Future studies should examine the utility of therapy matching or stepped-care principles, recognising that individuals with comorbid conditions—such as depression, anxiety, or post-traumatic stress disorder—may have different requirements and responses to treatment. Personalised approaches, leveraging psychosocial and pharmacological interventions, are likely to enhance retention and long-term recovery outcomes (Siefried et al., 2020).

### *Longitudinal Studies*

The short-term effectiveness of certain behavioural interventions has been established; however, the capacity of these interventions to sustain abstinence and functional recovery over extended periods is less clear. Longitudinal cohort designs can help elucidate the long-term trajectories of methamphetamine use, relapse risks, and enduring benefits of various treatment modalities, especially for under-researched groups such as older adults, women, and individuals in rural settings.

### *Policy and Community Engagement*

Collaboration between healthcare providers, law enforcement, and community-based organisations is vital. Integrated efforts can enhance early detection, minimise stigma, expand harm reduction services, and ensure comprehensive post-treatment support that addresses social determinants of health, including housing stability, vocational training, and mental health care (UNODC, 2022).

## Findings

Methamphetamine misuse poses a significant public health challenge in Malaysia, particularly among young adults. Its potent neurotoxic effects, coupled with its association with various health problems, including dental issues, skin lesions, and facial asymmetry, underscore the severity of the issue. Methamphetamine users often exhibit psychological issues such as aggression, psychosis, and mood disorders, and are at risk of social problems, including financial instability, crime, and strained relationships. Government efforts to curb

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methamphetamine misuse have been hindered by various factors, including the profitability of the drug trade and the adaptability of criminal networks. While psychosocial interventions, such as CBT and CM, have shown promise in treating methamphetamine addiction, pharmacological interventions remain limited in efficacy and safety. Future research should focus on combination therapies, personalized treatment approaches, and long-term follow-up studies. Policymakers and healthcare providers should collaborate to implement comprehensive strategies that address the multifaceted nature of methamphetamine misuse.

**Table 1: Key Findings on Methamphetamine Misuse in Malaysia**

| Key Finding | Source |
|---|---|
| Methamphetamine is a significant public health issue in Malaysia, particularly among young adults. | Mohd Nawawi et al., 2024 |
| Methamphetamine is a potent CNS stimulant that alters neurotransmitter levels, leading to neurotoxicity. | Der-Ghazarian et al., 2019 |
| Chronic methamphetamine use can cause severe neurological damage, including structural changes in the brain. | Nash & Yamamoto, 1992; Orikabe et al., 2011 |
| Methamphetamine misuse is associated with various health problems, including dental issues, skin lesions, and facial asymmetry. | Harastani et al., 2020 |
| Methamphetamine users often exhibit psychological issues such as aggression, psychosis, and mood disorders. | Hashisha et al., 2022 |
| Methamphetamine misuse is linked to social problems, including financial instability, crime, and strained relationships. | Langfield & Payne, 2020; Ibrahim et al., 2021 |
| Government efforts to curb methamphetamine misuse have been hindered by various factors, including the profitability of the drug trade and the adaptability of criminal networks. | UNODC, 2022 |
| Psychosocial interventions, such as CBT and CM, have shown promise in treating methamphetamine addiction. | Siegfried et al., 2020; Moszczynska, 2021 |
| Pharmacological interventions for methamphetamine addiction are still under development, with limited efficacy and safety data. | Ballester et al., 2016; Davis & Carter, 2023 |
| Future research should focus on combination therapies, personalized treatment approaches, and long-term follow-up studies. | Siegfried et al., 2020 |
| Policymakers and healthcare providers should collaborate to implement comprehensive strategies that address the multifaceted nature of methamphetamine misuse. | UNODC, 2022 |

## Conclusion

Methamphetamine misuse represents a critical public health and societal concern in Malaysia, mirroring wider global trends wherein stimulant abuse inflicts a significant toll on healthcare systems, families, and communities. Research underscores the drug's profound neurotoxic effects, encompassing structural and functional brain alterations that manifest in impaired cognition, increased aggression, heightened susceptibility to psychosis, and accelerated facial

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ageing. Concurrently, social repercussions—comprising escalated financial burdens, criminal activity, and fractured interpersonal relationships—reinforce the urgent need for effective prevention and intervention strategies.

Despite stringent legislation and targeted prevention efforts, methamphetamine consumption rates remain distressingly high. Evidence-based non-pharmacological methods, including cognitive-behavioural therapy, contingency management, the Matrix Model, and 12-step facilitation, have demonstrated encouraging albeit varied levels of efficacy. However, there is as yet no consensus on a definitive pharmacological agent for methamphetamine use disorder, even though emerging research on dopamine agonists, immunotherapies, and GABA-related medications offers some promise. The critical challenge lies in consolidating and expanding these preliminary findings to facilitate the establishment of robust, multidimensional treatment frameworks capable of addressing the nuanced and heterogeneous experiences of methamphetamine users.

The objectives of this review were to explore the multifaceted dimensions of methamphetamine misuse in Malaysia, identify key challenges, and propose future directions for research and policy. Based on the findings presented, it can be concluded that these objectives have been achieved.

However, it is important to acknowledge the limitations of this review. Firstly, the focus on English-language literature may have excluded relevant studies published in other languages. Secondly, the review primarily relied on quantitative research, potentially overlooking valuable qualitative insights into the lived experiences of methamphetamine users. Thirdly, the rapid evolution of the methamphetamine landscape may necessitate ongoing updates and revisions to the findings presented here.

Moving forward, research must delve deeper into combination interventions that integrate psychosocial and pharmacological modalities, tailor treatments to client-specific needs, and employ longitudinal approaches to assess sustained recovery. Moreover, policy reforms prioritising harm reduction, early screening, and community-driven initiatives are essential to mitigating the public health implications of methamphetamine misuse. By adopting a holistic, evidence-informed strategy that merges scientific understanding, compassionate care, and supportive socio-political environments, Malaysia can more effectively confront this deeply entrenched drug abuse issue, ultimately advancing the well-being of its population.

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