

Reframing drug abuse through science: A call for evidence-based policy and practice (*Scientific commentary*)

Ayodeji Saad Erubu¹

¹ Department of Mental Health, Afe Babalola University, Ado-Ekiti, Ekiti State, Nigeria

Correspondence: Ayodeji Saad Erubu, Faculty of Clinical Sciences, College of Medicine and Health Sciences, Afe Babalola University, Ado-Ekiti, Ekiti State, Nigeria. E-mail: ayorubu@gmail.com

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Abstract

Substance use remains a significant global public health challenge, yet responses to drug-related harms are often influenced by stigma, misinformation, and punitive approaches. This commentary argues for reframing drug abuse through a scientific lens that recognizes addiction as a complex health condition shaped by interactions among biological vulnerability, psychological processes, social environments, and lived experiences. Advances in neuroscience, genetics, and public health have demonstrated that substance use disorders involve changes in brain function and are influenced by broader social determinants of health. A science-based approach can improve prevention, treatment, policy, and public understanding by replacing moral judgment with evidence-informed strategies. Prioritizing research, accessible care, harm reduction, and stigma reduction is essential for developing more effective and compassionate responses to substance use disorders.

Keywords: addiction science, substance use disorders, neuroscience, evidence-based policy, public health.

Repensando o abuso de drogas sob a perspectiva da ciência: um chamado para políticas e práticas baseadas em evidências (*Comentário científico*)

Resumo

O uso de substâncias continua sendo um importante desafio global de saúde pública. No entanto, as respostas aos danos relacionados às drogas são frequentemente influenciadas pelo estigma, pela desinformação e por abordagens punitivas. Este comentário defende a reformulação da compreensão do abuso de drogas sob uma perspectiva científica, reconhecendo a dependência como uma condição complexa de saúde, moldada pelas interações entre vulnerabilidade biológica, processos psicológicos, ambientes sociais e experiências de vida. Os avanços na neurociência, na genética e na saúde pública demonstraram que os transtornos por uso de substâncias envolvem alterações no funcionamento cerebral e são influenciados por determinantes sociais mais amplos da saúde. Uma abordagem baseada em evidências científicas pode aprimorar a prevenção, o tratamento, as políticas públicas e a compreensão da sociedade, substituindo julgamentos morais por estratégias fundamentadas em evidências. Priorizar a pesquisa, o acesso aos cuidados em saúde, a redução de danos e a diminuição do estigma é essencial para desenvolver respostas mais eficazes e humanizadas aos transtornos decorrentes do uso de substâncias.

Palavras-chave: ciência da dependência, transtornos por uso de substâncias, neurociência, políticas baseadas em evidências, saúde pública.

1. Commentary

Substance use remains one of the most complex and concerning public health challenges of the modern era. Despite decades of scientific studies, drug-related harms continue to affect individuals, families, healthcare systems, and communities worldwide (UNODC, 2024). Traditionally, drug abuse has often been approached primarily through moral, criminal justice, or social perspectives. While these perspectives may address certain

aspects of substance-related problems, advances in neuroscience, psychology, epidemiology, and public health have demonstrated that problematic drug use is fundamentally a complex health condition influenced by biological vulnerability, environmental exposure, social circumstances, and individual experiences (Volkow; Blanco, 2023). A scientific understanding of drug abuse provides an opportunity to move beyond stigma and develop non-judgemental and more effective prevention, treatment, and policy approaches.

One of the most important contributions of modern science has been the recognition that addiction is not simply a failure of willpower. Research in neurobiology has demonstrated that repeated exposure to addictive substances produces measurable changes in brain systems involved in reward processing, motivation, decision-making, and stress regulation (Volkow; Blanco, 2023). Drugs such as opioids, stimulants, and alcohol can alter neural pathways, particularly those involving dopamine signalling, leading to persistent changes in craving, impulse control, and behavioural regulation (Uhl et al., 2019). These findings have transformed the understanding of addiction from a purely behavioural problem into a disorder involving complex interactions between brain function and environmental influences.

Genetic research has further strengthened this perspective. Evidence from family, twin, and molecular genetic studies suggests that vulnerability to substance use disorders is partly inherited, although no single gene determines whether an individual will develop addiction. Instead, hundreds of genetic variants interact with developmental experiences and environmental exposures to influence risk (Gerring et al., 2024). This biological vulnerability helps explain why individuals exposed to similar substances may experience very different outcomes. Some develop severe substance use disorders, whereas others do not.

However, recognizing the biological basis of addiction does not mean ignoring social and environmental factors. Scientific evidence consistently demonstrates that substance use disorders emerge through interactions between individual susceptibility and broader social conditions. Poverty, childhood adversity, trauma, mental health disorders, social isolation, and limited access to healthcare are important contributors to increased risk (McLellan, 2017). Therefore, effective responses must address not only the substance itself but also the circumstances that increase vulnerability.

Despite substantial scientific progress, public policy has not always kept pace with scientific evidence. Many approaches to drug control have historically emphasized punishment and criminalization rather than prevention, treatment, and harm reduction. Although law enforcement has a role in addressing illegal drug markets and associated harms, evidence suggests that punitive approaches alone are insufficient in reducing substance-related problems. Criminalization may discourage individuals from seeking healthcare due to fear of legal consequences and may worsen social inequalities among vulnerable populations (Csete et al., 2016).

A science-based approach requires greater investment in prevention and evidence-based treatment. Prevention programs that address risk factors early in life, strengthen social support, and improve mental health literacy have demonstrated effectiveness (Newton et al., 2021). Similarly, treatment strategies based on scientific evidence—including medication-assisted treatment for opioid use disorder, use of anti-craving medications to reduce compulsive substance use, behavioural therapies, and integrated care for co-occurring psychiatric conditions—can significantly improve outcomes when made accessible to those who need them (Volkow et al., 2023; Wakeman et al., 2020). Addiction should be managed as a chronic medical condition requiring sustained scientific, evidence-based care rather than as a problem resolved through punishment alone.

Science also has an important role in correcting misinformation and reducing stigma. Stigma remains a major barrier preventing many individuals from seeking treatment. People with substance use disorders are frequently viewed as lacking responsibility or moral character, despite evidence showing that addiction involves complex interactions between brain biology, psychology, and social environment. Such misconceptions can delay treatment, increase isolation, and worsen health outcomes (El Hayek et al., 2024). Public communication based on scientific evidence is therefore essential to promote understanding and encourage earlier intervention.

The future of drug policy should be guided by collaboration between scientists, healthcare professionals, policymakers, communities, and individuals with lived experience of addiction. Research must continue to explore innovative treatments, improve prevention strategies, and identify effective ways to translate scientific discoveries into practice. Importantly, policies should be evaluated according to measurable health outcomes rather than ideological assumptions.

Reframing drug abuse through science does not imply minimizing the consequences of substance misuse or disregarding personal and social responsibility. Instead, it represents a more realistic understanding of the origin of addiction and how it can be effectively addressed. Scientific evidence provides a pathway toward policies that are compassionate, practical, and focused on reducing harm. By placing research and public health principles at

the centre of decision-making, societies can move closer to preventing addiction, improving access to treatment, and supporting recovery.

2. Authors' Contributions

Ayodeji Saad Erubu: conceptualization, literature review, investigation, formal analysis, writing – original draft, writing – review & editing, visualization, supervision, and project administration.

3. Conflicts of Interest

No conflicts of interest.

4. Ethics Approval

Not applicable.

5. Artificial Intelligence Statement: Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that no generative artificial intelligence (AI) or AI-assisted tools were used at any stage of the preparation of this manuscript, including the writing, editing, data analysis, figure preparation, or the development of the graphical abstract. Therefore, no AI tools contributed to the content of this study, and the manuscript and graphical abstract were produced entirely by the authors.

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