

Review

Not peer-reviewed version

The Effect of Music Therapy on Substance Use Disorder Patients in the Rehabilitation Stage

[Jasmin Jabara](#) * and [Vivian Ooi](#)

Posted Date: 25 July 2024

doi: 10.20944/preprints2024071997.v1

Keywords: music therapy; substance use disorder (SUD); craving; addiction; emotional expression; depression



Preprints.org is a free multidiscipline platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Review

The Effect of Music Therapy on Substance Use Disorder Patients in the Rehabilitation Stage

Jasmin Jabara ^{*,†} and Vivian Ooi [†]

Walt Whitman High School, Bethesda, MD 20817, USA

* Correspondence: jasmin.jabara@gmail.com

[†] These authors contributed equally to this work.

Abstract: Substance use disorder (SUD) is a global health crisis that is becoming increasingly prevalent among younger generations and impacting the overall health of millions of people worldwide. Traditional treatment methods, including cognitive-behavioral therapies and medicinal-assisted treatments, often face limitations such as inconsistent efficacies and varying degrees of accessibility. Thus, there is a clear need for a new and innovative treatment strategy. Music therapy has recently gained attention through research as a promising non-pharmacological supplement to strengthen conventional SUD treatment methods. This review explores the potential benefits of music therapy in reducing substance cravings, alleviating depressive symptoms, and improving emotional expression among patients in the rehabilitation phase of SUD recovery. We review evidence from various studies and clinical trials to evaluate the efficacy of music therapy in improving standard treatment outcomes, with the results indicating that music therapy could be an effective complement to traditional treatment methods while noting that its efficacy could vary depending on the individual and type of intervention provided. The benefits of music therapy include accessibility of treatment for diverse patient groups and the potential for highly individualized care, although more research is needed to compare the efficacies of specific music treatment types for certain conditions and patient populations. Further research is also needed to validate the neurobiological mechanisms of music therapy, as well as increased communication between music therapists worldwide to enforce consistency in treatment methods and share learnings in this growing field.

Keywords: music therapy; substance use disorder (SUD); depression; craving; addiction; emotional expression

1. Introduction

Substance use disorder (SUD) is a global health crisis that can leave devastating effects on long-term health and well-being. This is driven by a growth in drug use. In 2021, 1 in every 17 people between the ages of 15 and 64 had reportedly used a drug (such as opiates, cocaine, cannabis, amphetamines, and opioids) in the past 12 months (United Nations Office on Drugs and Crime, 2023). Adolescents are also susceptible to these addictive substances, with “10.9% of eighth graders, 19.8% of 10th graders, and 31.2% of 12th graders reporting any illicit drug use in the past year” per results from the Monitoring the Future Survey (National Institute on Drug Abuse, 2023). Furthermore, among Americans aged 12 and older, 138.522 million reportedly consume alcohol and 57.277 million use tobacco or nicotine products.

According to the National Institute of Mental Health, the definition of SUD is a “treatable mental disorder that affects a person’s brain and behavior, leading to their inability to control their use of substances like legal or illegal drugs, alcohol, or medications” (National Institute of Mental Health, 2024). In the past year, 46.8 million Americans aged 12 and older suffered from SUD (National Institute on Drug Abuse, 2023). The prevalence of this issue warrants research into various non-invasive treatment methods that we review below.

2. Evaluation of Current and Potential Treatment Methods

Traditional SUD treatment methods are continuously being refined to effectively treat patients. These current treatments include cognitive behavioral therapy (talk therapy), dialectical behavior therapy (teaching skills to control emotions), therapeutic communities (long-term residential treatment to develop new behaviors), and contingency management (encouraging healthy behavior through rewards) (Cleveland Clinic, 2022). Addictions involving opioids rely on medication as the initial treatment, typically in conjunction with behavioral therapy. On the other hand, addictions involving cannabis or stimulants rely solely on behavioral therapy, with limited medications currently available to treat them (National Institute on Drug Abuse, 2020). While psychedelic-assisted therapy is an emerging treatment option, it is not entirely clinically validated/effective nor widely available (Marseille et al., 2022).

Despite their widespread use, traditional methods for treating SUD face significant limitations. One main challenge is the varying success in treatment effectiveness among individuals. According to a recent review regarding barriers to current SUD treatments, personal traits, family factors, and problems with the therapeutic team were among some of the common problems. (Farhoudian et al., 2022). These influences are inherently subjective and can vary significantly from one individual to another, making it difficult for current treatments to target a broader audience. Additionally, there exist barriers such as affordability or availability that restrict access to traditional treatment. In combination with these limitations, the rising prevalence of SUD highlights the need for novel supplementary therapies to aid current treatments. As current treatments can be complicated, difficult to access, and have limited efficacy, music therapy could serve as an attractive, low-cost intervention as an adjunct therapy.

With recent discoveries on the profound effects of music on structural adaptations in the brain, music therapy is an emerging non-pharmacological supplement to current SUD treatments (Zaatar et al., 2024). Its personalized approach—tailored to individual needs and backgrounds—allows for more versatility than standard treatments, targeting a broader audience with fewer limitations. In a study by Dingle and others that surveyed 143 patients undergoing treatment, 57% of the patients said that music played a “very important” role in their recovery process, and 27% said that music played an “important” role, demonstrating how music therapy can be leveraged as treatment due to its shared value in people’s lives (Dingle et. al, 2015). Music therapy offers a more inclusive and accessible approach to traditional methods, making it suitable and affordable for diverse populations and demographics. Additionally, unlike current medication-based interventions, music therapy can be implemented into ongoing treatment plans without the risk of additional substance use dependencies.

3. What is Music Therapy?

Music is a universal medium that knows no bounds, playing an integral role in a multitude of cultures. Humans make music by singing and playing instruments not only as an outlet for personal expression but to also connect with other people in social settings. Music can engender an emotional response regardless of language or cultural barriers; thus, it is unsurprising that people have recognized and leveraged its therapeutic value to treat certain conditions since ancient times. For instance, ancient Greek physicians played instruments such as the flute, lyre, and zither to treat their patients with mental disturbance, help patients sleep, and improve digestion (Meymandi, 2009).

Neurologically, music stimulates brain regions associated with reward, motivation, emotion, and arousal. Music-based interventions trigger cortical changes in patients with SUD-related brain damage, activating bilateral networks across various brain regions including the frontal, temporal, and parietal lobes, as well as the cerebellum and limbic areas. This music-based activation enhances cognitive, motor, and emotional processes (Magee, 2020).

Over time, the field of music therapy has become more well-defined and studied. Music therapy, a health profession, features the use of musical interventions by a qualified therapist to achieve patient-specific emotional or cognitive goals. Patients are not required to have any knowledge of music to benefit from treatment. Therapists consider tempo, dynamics, and pitch among other musical characteristics to determine the best treatment to address patient needs (Magee, 2020).

Activities can include songwriting, playing an instrument, discussing the meaning behind lyrics, and singing, moving rhythmically, or listening to music. Due to its perceived benefits in promoting movement, increasing engagement in treatment, and providing emotional support (American Music Therapy Association, 2024), music therapy is currently being used to treat various medical conditions including Parkinson's, Alzheimer's, autism, and depression. Music therapies can be classified into two categories: active or receptive interventions. During active interventions, patients are involved in producing music, while in receptive interventions, patients passively listen to music (de Witte et al., 2020). Music improvisation, performance, and composition are examples of active interventions, while music listening is a form of receptive intervention (Bruscia, 2014).

4. Application of Music Therapy in Substance Use Disorder Therapy

The main goals for SUD patients are to manage symptoms, create healthy relationships with trusted individuals, and provide psychosocial support to create a feeling of hope and to encourage recovery (Dvorak et al., 2021). Music therapy is currently being investigated as a supplement to conventional treatment methods. Various potential effects, with the most notable being the improvement of depressive symptoms, reduction of craving, and improvement of emotional expression, have been studied for decades to determine the different ways music therapy can enhance the recovery of SUD patients. A summary of relevant studies has been included in Table 1 below.

4.1. Reducing craving

Craving is a signature feature of addiction. There has been recent emphasis on research into methods to reduce craving as it is thought that heightened craving can lead to relapse or prevent patients from seeking proper treatment (Sayette, 2016). According to a Cochrane meta-review by Ghetti and others, three studies showed that the use of music therapy alongside standard care, compared to standard care on its own, showed a "substantial medium effect" on reducing substance craving as assessed by various standardized self-reporting scales (Ghetti et al., 2022).

Analysis of past neurological studies determined changes in areas of the drug-craving brain (such as the prefrontal complex, hippocampus, and amygdala) that are associated with the retrieval of emotional memories, suggesting that craving is associated with the recall of emotionally charged moments (Pasqualitto et al., 2023). Due to this association, it has been pointed out that music, which evokes emotion and can promote the resurfacing of memories, could act as an auditory cue for craving (Short et al., 2015). When participants in a study listened to a song associated with substance use, their cravings intensified, while when they listened to a song that was nominated to be associated with abstinence, their cravings decreased. This study suggests that personal associations with specific music are a factor to consider when employing music to manage symptoms. Another study corroborates this view as 43% of clients undergoing treatment said that they felt their cravings intensify when listening to certain music due to reasons such as how "the song was associated with past experiences of substance use; the song evoked emotions related to substance use; and the song contained lyrics about substance use" (Dingle et al., 2015). These findings indicate that therapists can ensure better rates of success by carefully curating music based on the individual patient.

4.2. Alleviating Depressive Symptoms

Depression, a common effect of SUD, is a prolonged feeling of sadness that impacts the quality of everyday life for patients. Causes of depression often include experiencing traumatic events, having a medical problem, and using drugs and alcohol (Tips from Former Smokers, 2023). Research suggests that the neurological basis of depression includes changes in the interactions between multiple brain regions such as the frontal lobe, hippocampus, temporal lobe, and thalamus (Zhang et al., 2018). Since music can improve emotional outcomes through modulation of similar limbic and paralimbic structures of the brain, it is reasonable to investigate its potential to alleviate depressive symptoms (Koelsch, 2014).

A review by Aalbers and others which looked at nine different studies featuring patients with depression showed that adding music therapy to traditional treatment reduced depressive symptoms and improved functioning more effectively than standard treatment alone (Aalbers et al., 2017). Results from a clinical study revealed that music therapy may be more effective than psychotherapy in improving depression in adults with low to medium-grade depression (Castillo-Perez, 2010). Findings from another study showed that, when compared to traditional treatment alone, SUD patients who engaged in group improvisation exercises showed an improvement in psychologist-rated depression but none in self-rated depression, suggesting that psychologists tended to observe improvement more than the patients themselves (Albornoz, 2011). However, it is important to note that the two tests used, HRSD for psychologists and BDI for self-rating, assess different components (HRSD measures anxiety and somatic distress while BDI measures subjective distress) and can thus lead to different results.

Current trials examining the effect of supplemental music therapy on improving depressive symptoms in SUD patients specifically have produced mixed results in terms of effectiveness compared to regular treatment alone. However, it is hypothesized that such differences in response could be due to individual preferences for certain types of music therapy interventions over others. In a study that investigated the effect of music therapy on a group of females, it was observed that certain individuals responded to particular interventions more readily than others (Cevasco et al., 2005). In two client cases, movement-to-music intervention had a greater effect than rhythm activities.

4.3. Evoking positive emotional expression

One important outcome of SUD treatment is to promote the expression of positive feelings. Music has been known to evoke emotional responses and numerous studies have been conducted to demonstrate the connection between music and neuroscience. A study found that listening to music modulates activity in structures such as the nucleus accumbens, ventral tegmental area, hypothalamus, and insula, which are all part of the reward processing system (Menon & Levitin, 2005). An association between the release of dopamine and the nucleus accumbens was observed as well. The connectivity between reward-processing centers of the brain suggests a reason why listening to music can be an emotionally positive experience.

Many studies have shown how music is an effective tool in regulating emotional expression in people in general. Particularly, results from one pilot study showed that mood states (composed-anxious, energetic-tired, and agreeable hostile) changed positively in neurological patients between pre- and post-intervention with music therapy (Magee & Davidson, 2002). One review showed that, across several studies, music therapy increased positive feelings and decreased negative feelings in SUD patients (Hohmann, 2017). This is because music therapy provides a healthy outlet to explore and express their emotions as they navigate through recovery. In one study, through lyric analysis and songwriting activities (Jones, 2005), patients exhibited an increase in feelings of “acceptance, joy, happiness, or enjoyment” and “a decrease in feelings of guilt, regret, blame, fear, or distrust”. Music therapy is also found to help alleviate loneliness by encouraging imagination and is a medium for emotional relief (Bensimon, 2024).

Table 1. Summary of relevant studies or sections of relevant studies.

Condition	Study	Group	vs	Methods of Evaluation	Effect
		Control Group			
Patients with depression	with treatment as usual	Music therapy	with	Clinician-related depressive symptoms	There was a large effect for depressive

(Aalbers et al., 2017)	vs	and patient-reported symptoms in the treatment as usual depressive symptoms music therapy group—including less anxiety and improved functioning—reported by clinicians and patients
Patients with low to medium-grade depression (Castillo-Perez, 2010)	Music therapy vs psychotherapy	Zung Self-Rating Depression Scale Musical therapy group had fewer depressive symptoms than the psychotherapy group
Patients with depression recovering from substance abuse (Albornoz, 2011)	Group improvisational music therapy vs standard treatment program	Hamilton Rating Scale for Depression Patients were significantly less depressed with group improvisational music therapy
Patients with chemical dependence (Jones, 2005)	Pre- and post-songwriting and lyric analysis	Visual Analog Mood Scale Significant reduction in feelings of “guilt/regret/ blame and fear.” Significant increase in feelings of “acceptance/ joy/happiness/or enjoyment”

Female patients in substance abuse rehabilitation (Cevasco et al., 2005)	Movement-to-music activities vs rhythm activities vs competitive games (no control group)	Likert rating scale (for depression, stress, anxiety, and anger), State-Trait Anxiety Inventory test and Novaco Anger Inventory Short Form	Individuals saw a decrease in depression, stress, anxiety, and anger after all three types of interventions
Patients in treatment for SUD (Short et al., 2015)	“Urge” (stimulate craving) songs vs “clean” (decrease craving) songs vs no song	Likert rating scale and Alcohol Urge Questionnaire	Listening to an urge song increased craving intensity and urge to use substances while listening to a clean song returned craving ratings to baseline
Patients in treatment for SUD (Dingle et al., 2015)	Craving states pre- and post-music therapy	Survey (created by investigators) with questions about the emotional response to music, enjoyment, and craving as well as the Depression, Anxiety, and Stress Scale	Forty-three percent of participants felt that listening to certain songs increased their urge to use substances. Fifty-nine songs that triggered the urge were identified, with the most common genres being rock and rap/hip-hop

5. Discussion

Based on the studies and reviews examined, the addition of music therapy to traditional treatment can help manage craving, mitigate depressive symptoms, and improve emotional expression. However, it should be noted that the extent of effectiveness could vary based on the individual and the type of intervention provided. People can have or develop emotional connections with certain types of music and this should be considered when music therapists select intervention activities. Furthermore, the mixed results of different studies could be attributed to differences in the types of interventions used in the studies. Music therapy is a large umbrella term for a variety of distinct interventions, such as but not limited to improvisation, lyric recall, and songwriting. Since no “standardized” intervention method exists, one intervention may be more effective than another when treating a certain symptom of SUD. This will have to be further investigated through future studies.

As with the majority of novel strategies, more research into the neurobiological mechanisms of music therapy on the brains of recovering SUD patients will help to better understand the effectiveness of music therapy as a supplement to traditional substance use treatment. An emphasis on examining the effect of distinct, specific interventions could also yield more data and studies to help determine whether a certain intervention may be more appropriate to treat particular conditions or the use of specific substances.

Due to its accessibility and ability to be tailored to individual patient needs, music therapy is currently used as a part of SUD treatments in many countries, helping large demographics of people globally. Whether in community mental health centers, hospitals, or therapeutic communities, music therapy is used as a supplementary component within the broader framework of multidisciplinary substance use treatment (Ghetti et al., 2022).

However, in some countries, music therapy is not yet recognized as a formal treatment or supplement due to music’s strong presence in everyday life and culture. Studies in Uganda, rural Bangladesh, South Africa, and the Balkans noted the role of music in daily routines to convey self-expression and unite community members (Fitzsimons, 2016). Due to its already established role in many underserved countries, it could easily be integrated as a supplementary aspect to therapy treatments. Studies have already identified several common music therapy interventions tailored for poverty-stricken families, indicating its efficacy in disadvantaged countries. Some of the most common interventions include songwriting, music listening, and improvisational music playing (Nagel & Silverman, 2017).

Music therapy also serves as an accessible intervention with few barriers, as it does not require access to technology (the ability for live human-curated music) or financial capabilities. Due to such accessibility, supplementary music therapy treatment would be easy to integrate into underserved countries without the need for extensive resources. However, it is important to note the training necessary for music therapists to provide their work in a culturally appropriate manner. Countries such as the UK require their arts therapists to factor inclusion and cultural awareness into their work as outlined in point 5.8 of HCPC (2023) which emphasizes the need to ‘take account of psychological, social, cultural, economic and other relevant factors when collecting case histories and other appropriate information’ (HCPC, 2023).

Moreover, music therapy has been approved to help various demographics, including those with disabilities. Under the Individuals with Disabilities Act (IDEA), music therapy is recognized as a special education service that can serve students with disabilities (American Music Therapy Association, 2021). From children with disabilities to adults with SUD, music therapy is extremely versatile in its potential applications.

Despite its inclusion of various demographics and the widespread practice of music therapy globally with unique approaches in different regions, there is a limited international collaboration among researchers studying its application in SUD. Collaboration and discussion are necessary to further progress. Improving communication pathways between music therapists and researchers could lead to better data and more consistent outcomes. As the field continues to grow and research

advances, commonalities in music therapy techniques to treat SUD across the globe could benefit individuals and communities worldwide.

References

- Aalbers, S., Fusar-Poli, L., Freeman, R. E., Spreen, M., Ket, J. C., Vink, A. C., Maratos, A., Crawford, M., Chen, X. J., & Gold, C. (2017). Music therapy for depression. *The Cochrane database of systematic reviews*, 11(11), CD004517. <https://doi.org/10.1002/14651858.CD004517.pub3>
- Albornoz, Y. (2011). The effects of group improvisational music therapy on depression in adolescents and adults with substance abuse: a randomized controlled trial. *Nordic Journal of Music Therapy*, 20(3), 208-224. <http://dx.doi.org/10.1080/08098131.2010.522717>
- American Music Therapy Association. (2024). *About music therapy & AMTA*. <https://www.musictherapy.org/about/>
- American Music Therapy Association. (2021). Fact sheet: Music Therapy in special education. https://www.musictherapy.org/assets/1/7/FactSheet_Music_Therapy_in_Special_Education_2021.pdf
- Bensimon, M. (2024). Beneficial and harmful music for substance use disorder clients: Implementation of the musical presentation technique. *The Arts in Psychotherapy*, 87, 102121. <https://doi.org/10.1016/j.aip.2024.102121>
- Bruscia K. E. (2014). *Defining music therapy*. 3rd edn University Park, IL: Barcelona Publishers.
- Castillo-Perez, S., Gomez-Perez, V., Velasco, M. C., Perez-Campos, E. & Mayoral, M. (2010). Effects of music therapy on depression compared with psychotherapy. *The Art in Psychotherapy*, 37(5), 387-390. <https://doi.org/10.1016/j.aip.2010.07.001>
- Cevasco, A. M., Kennedy, R., & Generally, N. R. (2005). Comparison of Movement-to-Music, Rhythm Activities, and Competitive Games on Depression, Stress, Anxiety, and Anger of Females in Substance Abuse Rehabilitation. *Journal of Music Therapy*, 42(1), 64-80. <https://doi.org/10.1093/jmt/42.1.64>
- Cleveland Clinic. (2020, October 20). *Substance use disorder*. <https://my.clevelandclinic.org/health/diseases/16652-drug-addiction-substance-use-disorder-sud>
- de Witte, M., Lindelauf, E., Moonen, X., Stams, G. J., & van Hooren, S. (2020). Music Therapy Interventions for Stress Reduction in Adults With Mild Intellectual Disabilities: Perspectives From Clinical Practice. *Frontiers in Psychology*, 11, 572549. <https://doi.org/10.3389/fpsyg.2020.572549>
- Dingle, G. A., Kelly, P. J., Flynn, L. M., & Baker, F. A. (2015). The influence of music on emotions and cravings in clients in addiction treatment: A study of two clinical samples. *The Arts in Psychotherapy*, 45, 18-25. <https://doi.org/10.1016/j.aip.2015.05.005>
- Dvorak, A.L., Carvalho, S., Rosey, C., Welch, J., Wierman, A., Bernard, G., Steele, K., & Silverman, M. J. (2021). *Music therapy for adults with mental health and substance use conditions*. American Music Therapy Association. https://www.musictherapy.org/assets/1/7/FactSheet_Music_Therapy_for_Adults_with_Mental_Health_and_Substance_Use_Conditions_2021.pdf
- Farhoudian, A., Razaghi, E., Hooshyari, Z., Noroozi, A., Pilevari, A., Mokri, A., Mohammadi, M. R., & Malekinejad, M. (2022). Barriers and facilitators to substance use disorder treatment: An overview of systematic reviews. *Substance Abuse: Research and Treatment*, 16, 11782218221118462. <https://doi.org/10.1177/11782218221118462>
- Fitzsimons, B. (2016). Approaching music therapy in a different country: A literature review on cultural considerations when practising in a developing country. *British Journal of Music Therapy*, 30(2), 83-88. <https://doi.org/10.1177/1359457516667930>
- Ghetti, C., Chen, X. J., Brenner, A. K., Hakvoort, L. G., Lien, L., Fachner, J., & Gold, C. (2022). Music therapy for people with substance use disorders. *Cochrane Database of Systematic Reviews*, 5(5), CD012576. <https://doi.org/10.1002/14651858.CD012576.pub3>
- Health and Care Professions Council (2023, January 9). *The standards of proficiency for arts therapists*. <https://www.hcpc-uk.org/standards/standards-of-proficiency/arts-therapists/>
- Hohmann, L., Bradt, J., Stegemann, T., & Koelsch, S. (2017). Effects of music therapy and music-based interventions in the treatment of substance use disorders: A systematic review. *PloS One*, 12(11), e0187363. <https://doi.org/10.1371/journal.pone.0187363>
- Jones J. D. (2005). A comparison of songwriting and lyric analysis techniques to evoke emotional change in a single session with people who are chemically dependent. *Journal of Music Therapy*, 42(2), 94-110. <https://doi.org/10.1093/jmt/42.2.94>
- Koelsch, S. (2014) Brain correlates of music-evoked emotions. *Nature Review Neuroscience*, 15, 170-180. <https://doi.org/10.1038/nrn3666>
- Magee, W. L., & Davidson, J. W. (2002). The effect of music therapy on mood states in neurological patients: a pilot study. *Journal of Music Therapy*, 39(1), 20-29. <https://doi.org/10.1093/jmt/39.1.20>
- Magee, W. L. (2020). Why include music therapy in a neurorehabilitation team? *Advances in*

- Clinical Neuroscience and Rehabilitation*, 19(2):10-12. <https://doi.org/10.47795/STUI1319>
- Marseille, E., Bertozzi, S., & Kahn, J. G. (2022). The economics of psychedelic-assisted therapies: A research agenda. *Frontiers in psychiatry*, 13, 1025726. <https://doi.org/10.3389/fpsy.2022.1025726>
- Menon, V. & Levitin, D. J. (2005). The rewards of music listening: Response and physiological connectivity of the mesolimbic system. *NeuroImage*, 28(1), 175-184. <https://doi.org/10.1016/j.neuroimage.2005.05.053>
- Meymandi, A. (2009). Music, medicine, healing, and the genome project. *Psychiatry (Edmont (Pa. : Township))*, 6(9), 43–45. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2766288/>
- Nagel, J. J., & Silverman, M. J. (2017). Experiences and perspectives of music therapists providing services to families experiencing poverty: A qualitative investigation. *Voices: A World Forum for Music Therapy*, 17(2). <https://doi.org/10.15845/voices.v17i2.914>
- National Institute of Mental Health. (2024, March). *Substance use and co-occurring mental disorders*. [https://www.nimh.nih.gov/health/topics/substance-use-and-mental-health#:~:text=Substance%20use%20disorder%20\(SUD\)%20is,most%20severe%20form%20of%20SUD](https://www.nimh.nih.gov/health/topics/substance-use-and-mental-health#:~:text=Substance%20use%20disorder%20(SUD)%20is,most%20severe%20form%20of%20SUD)
- National Institute on Drug Abuse. (2023, December 13). *Reported drug use among adolescents continued to hold below pre-pandemic levels in 2023*. <https://nida.nih.gov/news-events/news-releases/2023/12/reported-drug-use-among-adolescents-continued-to-hold-below-pre-pandemic-levels-in-2023#:~:text=The%20percentage%20of%20adolescents%20reporting,to%20the%20latest%20results%20from>
- National Institute on Drug Abuse. (2023, September 25). *Treatment and recovery*. <https://nida.nih.gov/publications/drugs-brains-behavior-science-addiction/treatment-recovery>
- Pasqualitto, F., Panin, F., Maidhof, C., Thompson, N., & Fachner, J. (2023). Neuroplastic changes in addiction memory—How music therapy and music-based intervention may reduce craving: A narrative review. *Brain Sciences*, 13(2), 259. <https://doi.org/10.3390/brainsci13020259>
- Sayette, M. A. (2016). The role of craving in substance use disorders: Theoretical and methodological issues. *Annual Review of Clinical Psychology*, 12, 407–433. <https://doi.org/10.1146/annurev-clinpsy-021815-093351>
- Short, A. D. L., & Dingle, G. A. (2016). Music as an auditory cue for emotions and cravings in adults with substance use disorders. *Psychology of Music*, 44(3), 559-573. <https://doi.org/10.1177/0305735615577407>
- Tips from Former Smokers. (2023, October 13). *Mental health conditions: Depression and anxiety*. Centers for Disease Control and Prevention. <https://www.cdc.gov/tobacco/campaign/tips/diseases/depression-anxiety.html>
- United Nations Office on Drugs and Crime. (2023, June). *World drug report 2023: Executive summary*. UNODC Research. https://www.unodc.org/res/WDR-2023/WDR23_Exsum_fin_SP.pdf
- Zaatar, M. T., Alhakim, K., Enayeh, M., & Tamer, R. (2023). The transformative power of music: Insights into neuroplasticity, health, and disease. *Brain, Behavior, & Immunity - Health*, 35, 100716. <https://doi.org/10.1016/j.bbih.2023.100716>
- Zhang, F. F., Peng, W., Sweeney, J. A., Jia, Z. Y., & Gong, Q. Y. (2018). Brain structure alterations in depression: Psychoradiological evidence. *CNS Neuroscience & Therapeutics*, 24(11), 994–1003. <https://doi.org/10.1111/cns.12835>

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.