

■ REVIEW ARTICLE

# Impact of Physical Activity on Forensic Psychiatric patients: A Rehabilitative Approach

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## ABSTRACT

**CONTEXT:** Forensic psychiatry is comparatively a new upcoming and developing field in India. Substance use and mental illness have been independently associated with violence, and sometimes violent crimes. Forensic psychiatric patients, detained under sections of the mental health act, are particularly prone to developing poor physical health during the time it takes to stabilize and improve their mental health. A large and growing body of evidence suggests that physical activity (PA) may hold therapeutic promise in the management of mental health and metabolic disorders. Incorporating physical activity as an integral part of treatment strategies would appear to go a long way toward reducing the adverse health impact in forensic psychiatric care.

**KEY MESSAGES:** Modern forensic psychiatry has benefited from the evolution in the medico-legal understanding and appreciation of the relationship between mental illness and criminality, evolution of the legal tests to define legal insanity and the new methodologies for the treatment of mental conditions that provide alternatives to custodial care. Few interventions exist whereby patients can hope to achieve improvements in both psychiatric symptoms and physical health simultaneously without significant risks of adverse effects. Physical activity offers substantial promise for improving outcomes for people living with mental illness and substance use disorder under forensic psychiatric care.

**KEYWORDS** | X-ray fluorescence, Scanning electron microscopy, Dynamic light scattering

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## INTRODUCTION

**F**ORENSIC PSYCHIATRY IS A PARTICULAR BRANCH that emerged a few decades ago, and since then, its role has constantly risen in importance. According to the American Board of Forensic Psychiatry and the American Academy of Psychiatry and Law, it is defined as 'a subspecialty of psychiatry in which scientific and clinical expertise is applied to legal issues in legal context, embracing civil, criminal, correctional, or legislative matters'.<sup>1</sup> There is a dynamic relationship between the concept of mental illness, treatment of the mentally ill, and the law. The aim of forensic psychiatric care is

to care for, treat and rehabilitate patients back to independent life outside of hospital without recidivism into serious crime. Although the legal regulation of forensic psychiatric care differs from country to country, these patient groups are often distinguished by severe mental illness, a high risk of recidivism, complex rehabilitation and long hospital stays. These forensic psychiatric patients often have a psychotic disorder, combined with substance use, and are receiving treatment with antipsychotics.<sup>2</sup> Treatment often continues for several years<sup>3</sup> and there is a high risk of criminal recidivism

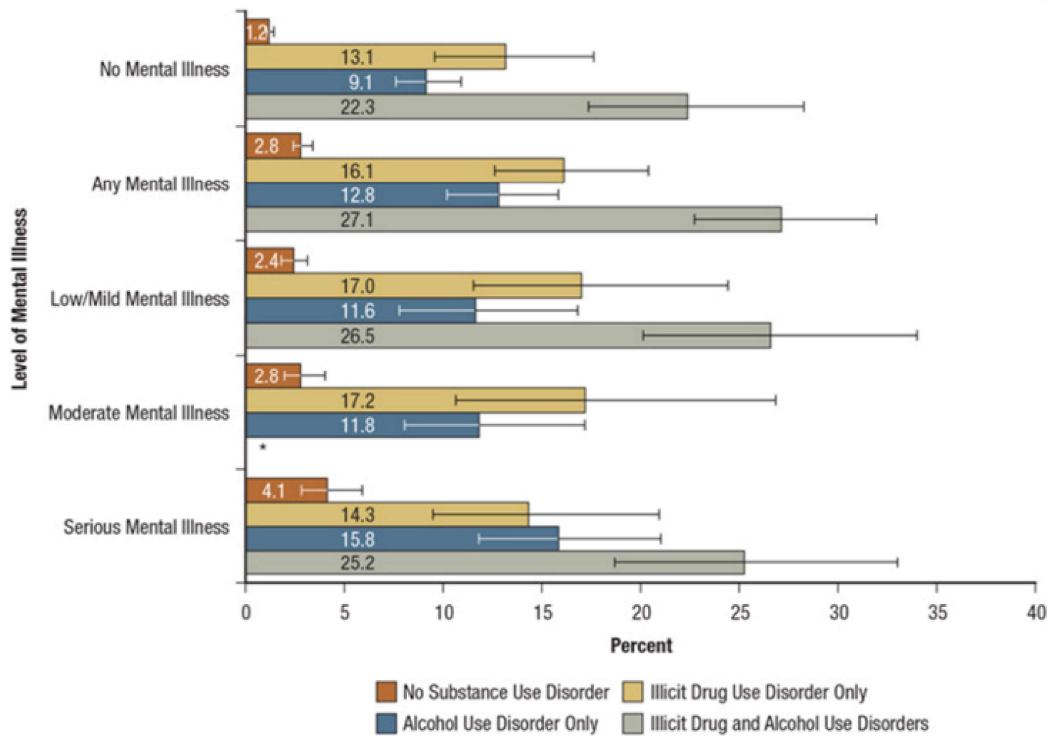


Figure 1: Prevalence of arrest in the past year among persons aged 18 or older with any mental illness, by level of mental illness and substance use disorder. Source: SAMHSA National Surveys on Drug Use and Health (NSDUHS)

after the end of treatment.

In forensic psychiatry cases, it is necessary to ascertain the risk of recurrence of violence. It is always important for a clinician to aid the legal system in balancing the rights of the individual to live freely in the community and the community's safety. It becomes important in cases where patients are acquitted of their charges on the grounds of an insanity plea. A risk assessment indicated that it could be dangerous to others because of any underlying brain pathology, mental illness, alcohol or drug dependence syndrome, poor family support and relationships, a prior history of poor compliance to medication, and a history of violent crimes, all of which suggested that there is a possibility of recurrence of intoxication/violence. It was opined that the patient would require treatment in a supervised setting in a long-term continuous-care home.

A person with a severe mental disorder, who commits a serious criminal offence, is sentenced to compulsory forensic psychiatric

care. A majority have committed violent crimes, such as assault and arson. Of these patients, 70% have previously been in contact with mental health services. The most common diagnoses are psychotic disorders. In addition, 63% have a history of substance-use disorders<sup>2</sup> (Figure 1). Patients with mental disorders have a life expectancy of at least 10 years shorter than the general population.<sup>4</sup> The predominant cause of this shortened lifespan in severe mental disorder is cardiovascular disease and other physical disorders. Patients with severe mental disorder are at a higher risk of developing diabetes and metabolic syndrome. They live a sedentary lifestyle compared to the general population and have low levels of physical activity, all of which increase the risk of cardiovascular disease (CVD). Furthermore, patients with severe mental disorder have low maximal oxygen uptake (VO<sub>2</sub>max), which is an independent risk factor for cardiovascular disorders in the general population. Exercise, on the other hand, acts as a protector against

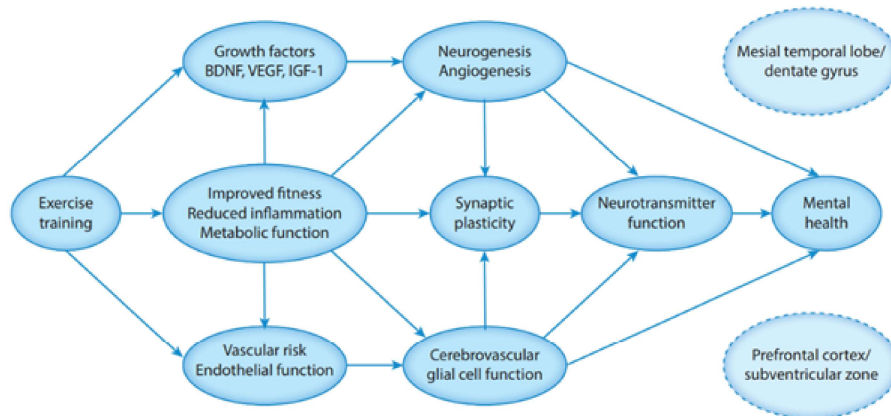


Figure 2: Mechanisms by which exercise training improves mental health outcomes. Abbreviations: BDNF, brain-derived neurotrophic factor; IGF-1, insulin-like growth factor 1; VEGF, vascular endothelial growth factor.

cardiovascular disease.<sup>5</sup>

There is a dearth of research concerning effective interventions for improved physical and mental health for this client group, perhaps because security and staffing issues present significant challenges to conducting research in this environment. Also, despite the established health benefits of physical activity, the impact that physical activity may have on physical health outcomes in people diagnosed with mental illness and substance use disorder is unclear and a neglected component of previous literature reviews and interventional studies. Thus, this study is to provide an overview on the use of physical activity for the rehabilitation of forensic psychiatry patients that have been published and to sum up the current research evidence as well as future directions for incorporating the physical activity as an effective adjunct therapy in rehabilitative practice that could enhance the treatment outcomes.

**Physical activity and Forensic Psychiatry: Experimental Evidence**

Physical activity has been recognized as a key component of a holistic approach to recovery within mental health services, with the potential benefits ranging from a reduction in symptoms to an improvement in service engagement and utilization.<sup>6</sup> Physical activity is a broader

concept than exercise and encompasses exercise as well as non-exercise interventions.<sup>7</sup> Impaired brain health in forensic psychiatric patients may have a number of different causes and result in different effects on the body, the psyche and on behaviour. Some of the obvious causal factors that are often seen in patients include early and long-lasting, extensive substance use, and a psychotic disorder with persistent negative or cognitive symptoms. The brain is affected in various ways by physical illnesses that can often be investigated and treated. The risk of developing diabetes<sup>8</sup>, metabolic syndrome<sup>9</sup> and cardiovascular disease<sup>10</sup> is heightened with psychotic disorders. Cardiovascular disease, diabetes and metabolic syndrome are all linked to poorer cognitive functions.<sup>11</sup> The causes of compromised cardiometabolic health within this population are multifactorial and include low levels of physical activity and higher prevalence of smoking as well as weight gain, dyslipidaemia, and insulin resistance, particularly associated with the use of second-generation antipsychotic medication. Structured interventions for lifestyle changes, with targets such as the patient giving up smoking or losing weight, can have beneficial effects on physical and mental health.<sup>12</sup>

Evidence supporting the promotion of exercise within acute inpatient settings leads experts to suggest this should now form a part

of treatment.<sup>13,14</sup> Mutrie (2000) recommended aerobic and anaerobic exercise to alleviate depression. Biddle (2000) has shown emotion and mood is improved during effort toward the mastery of skills in PA and PA conducted in group climates. Fox (2000) says that 'global' esteem is improved as 'physical esteem' is enhanced through exercise, whilst Taylor (2000) shows that anxiety and stress is reduced by moderate exercise,<sup>15</sup> also illustrated how PA interventions independently aid attempts to quit smoking.<sup>16</sup> Positive social experiences may be gained by mental health service-users from group-based PA<sup>17</sup> and PA and sport generally have the potential to offer a sense of purpose and meaning to the lives of people with mental health problems.<sup>18</sup> Many service users understand and value the potential benefits of PA, although clear barriers to becoming more active exist for this group.<sup>19</sup> The benefits of PA and exercise on mental health symptoms, such as depression, anxiety and psychosis are well known. In addition to mental health benefits, exercise can attenuate antipsychotic-induced weight gain and improve cardiometabolic profiles in people with mental illness. More importantly, exercise can improve cardiorespiratory fitness, an independent predictor of all cause mortality.<sup>20</sup>

A patient may have difficulty in controlling feelings of aggressions, anxiety and frustration with the new restricted environment. These may lead to some form of acting-out behaviour. In these circumstances exercise can be used constructively to channel release of those feelings in an acceptable and positive way. Physically based, muscle relaxation technique proved to be effective. Four-week Tai Chi intervention reduced sensitivity and attentional bias to drug-related cues in individuals with MUD, suggesting that mind-body exercise might enhance recovery from methamphetamine use disorder (MUD) via attention control and induce similar beneficial effects on the abstinence rate, withdrawal symptoms, anxiety, and depression levels in subjects with SUD.<sup>21,22</sup>

### **Physical Activity and Forensic Psychiatry: Explanatory Mechanisms**

Several researches linking exercise to mental health suggests that exercise training is beneficial for a broad array of mental health outcomes, although the strength of treatment benefit appears to vary across populations and training modalities. The exercise training likely improves mental health through synergistic influences of both neurobiological and behavioral learning mechanisms. Neuroplasticity is increasingly characterized as a central mechanistic component of mental health improvements and is highly influenced by PA. Within this framework,<sup>23</sup> training improves neurobiological systems critical for adaptive learning, as well as affective and cognitive control processes, resulting in synergistic improvements in the regulation of both cognitive and affective responses through a "virtuous circle" of reinforcement<sup>24</sup> (Figure 2).

Low oxygen uptake ability is an independent risk factor for cardiovascular disease and premature death. Low oxygen uptake ability has been demonstrated in patients with a psychotic disorder and in patients in forensic psychiatric care. Aerobic exercise offers one possibility for improving patients' general health and their cognitive functions possibly via activation of neurotrophic factors, such as BDNF (brain-derived neurotrophic factor), and brain repair although the mechanism is not fully understood. In patients with schizophrenia, aerobic exercise has positive effects on psychotic symptoms, cognitive function, general functional outcomes and quality of life. Aerobic exercise can also be expected to reduce the incidence of metabolic syndrome in forensic psychiatric patients and thereby reduce cardiovascular morbidity, diabetes and premature death.<sup>25</sup>

Regular exercise can help to reduce weight, reduce blood pressure, and improve lipid disorders, including raising HDL (high-density lipoprotein) and lowering triglycerides.<sup>26</sup> Among the physiological systems that respond favorably to physical activity, it has been argued that one source of insulin-mediated glucose



uptake and fatty acid oxidation. The exposure to exercise evokes adaptation in skeletal muscle in a multitude of signaling pathways, the functional response to which is determined by training volume, mode of training, intensity and frequency. With persistent exercise exposure, there is mitochondrial biogenesis, fast-to-slow fiber-type transformation, changes in substrate metabolism, and angiogenesis. Moreover, a host of myokines are released from active muscles providing communication throughout the body. Enhanced fitness is associated with high levels of insulin sensitivity/insulin action. While glucose homeostasis at rest is insulin-sensitive, exercise with muscle contractions increases glucose uptake from the circulation that is not reliant on insulin. Indeed, GLUT-4 (Glucose transporter type 4) is responsive to both insulin and muscle contraction independently. The increased glucose disposal associated with resistance exercise was the result of the increase in the quantity of lean body mass, without altering the intrinsic capacity of the muscle to respond to insulin.<sup>28</sup> On the other hand, endurance training enhanced glucose disposal independent of changes in lean body mass or VO<sub>2</sub>max, suggestive of an intrinsic change in the ability of the muscle to metabolize glucose. Moreover, abdominal fat and fat-derived mesenchymal stem cells are responsive to physical activity; both high-intensity aerobic and resistance training decrease visceral fat effectively while the molecular expression of fat-derived mesenchymal stem cells is significantly altered with exercise preventing adipogenesis.<sup>29</sup>

There is evidence suggesting that PA increases peripheral insulin growth factor 1 (IGF-1) levels and elevated serum IGF-1 levels are associated with improved cognitive performance. It is therefore likely that IGF-1 plays a role in PA induced improvement of cognition. Other neuropeptides such as neuropeptide Y (NPY), ghrelin, galanin, and vasoactive intestinal peptide (VIP) could mediate the beneficial effects of PA on cognition.<sup>30</sup>

Studies showed that physical exercise can

regulate the gene transcription of endogenous opium brain-derived neurotrophic factor (BDNF) by activating the cyclic AMP response element-binding (CREB) protein and synaptic plasticity, which is critical for rehabilitation for patients with substance use disorders (SUD) via promoting repair of drug-induced neuronal damage and improving corresponding brain functions. This neuronal structural change induced by exercises might contribute a long-lasting effect on SUD.<sup>31</sup>

A multitude of studies have been conducted showing a relationship between physical activity and overall well-being. It has been repeatedly shown that an inverse relationship exists between physical activity and the occurrence of CVDs (i.e., with increased physical activity, the relative risk of developing CVD is decreased. With regard to specific surrogate markers and biological factors pertaining to CVD risk factors (e.g., high BP, and increased cholesterol and triglyceride concentrations), clinical and laboratory evaluations have been performed to show the benefits of physical activity. Such quantitative measurements were performed to determine the influence of exercise on blood coagulation and fibrinolysis, vascular remodeling, BP and blood lipid profiles.<sup>32</sup>

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#### CONCLUSION

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The review concludes that physiotherapeutic interventions, including individually adapted physical activity and exercise, if monitored and incorporated into forensic psychiatric care, could improve the patients' physical status and thereby lower the risk of cardiovascular disease. Importantly, it could ameliorate psychiatric symptoms and improve overall cognitive function making it an interesting and promising treatment option in forensic psychiatric care. From a medical-psychiatric perspective, the patient should be investigated and treated for physical illnesses with particular focus on metabolic syndrome and other risk factors for cardiovascular disease and diabetes. **IJFMP**

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