


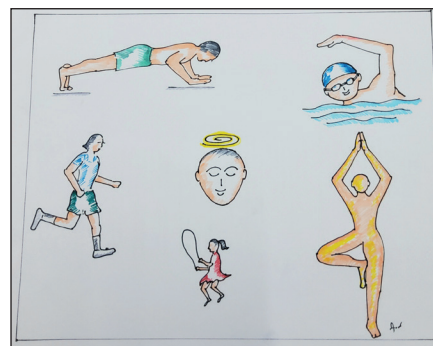
# Prescribing Physical Activity in Mental Health: A Focused Review on the Latest Evidence, Recommendations, Challenges, and Relevance to India

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Physical activity and mental health are intimately linked. Physical activity has been considered to have a significant impact on global mental health, cognitive functions and, well-being and quality of life.<sup>1</sup> Global Action Plan on Physical Activity (GAPPA) 2018–2030 of the World Health Organization (WHO) has envisioned improvements in these “health and well-being” parameters by improving levels of physical activity.<sup>1</sup> Currently, the global rates of “insufficient physical activity” are 27.5% (23.4% for males and 31.7% for females).<sup>2</sup> GAPPA aims at achieving 10% and 15% reductions in physical inactivity rates by 2025 and 2030, respectively, for attaining the envisioned improvements. The WHO deems physical activity to contribute in achieving 13 of the 17 sustainable development goals (SDGs)—2030.<sup>1</sup>

Beyond the common supposition that enhancements in mental health by physical activity might be indirect, that

is, improvement in diabetes and cardiovascular disease statuses being the moderator, physical activity has direct benefits on mental health too. In this focused review, we provide an appraisal



of the latest available evidence on the mental health benefits of physical activity and specific recommendations. To understand the biological validity of the evidence and recommendations, we also briefly discuss the science behind the role of exercise and mental health. The

challenges, especially those relevant to the Indian context, and methods to enhance the acceptability of physical activity in our population are also discussed.

## Neurobiology of Exercise and Mental Health

Although transient, the commonest known immediate mental health benefit of physical activity is what is termed “runner’s high,” which is the experience of euphoria post an endurance run. Ever since it was recognized as a substrate to understand the effects of exercise on the brain,<sup>3</sup> the role of several neural mechanisms has been postulated. The role of endorphins and enhanced opioid signaling, the endocannabinoids such as anandamide, monoamines—dopamine and serotonin, neurotrophins such as the brain-derived neurotrophic factor (BDNF), and gamma-aminobutyric acid (GABA) have been hypothesized.<sup>5</sup> Recently,

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claims of a transcriptional signature for “runner’s high” in the form of microribonucleic acid (miRNA) dynamics have also surfaced.<sup>4</sup>

Overall, three levels of cellular mechanisms have been identified to underlie the effects of exercise on the brain: (1) Increases in synthesis and release of various neurotransmitters—monoamines, GABA, etc.—and neurotrophic factors such as BDNF, (2) these increases lead to mitochondrial biogenesis and consequent protein synthesis within the endoplasmic reticulum, and (3) neurogenesis, angiogenesis, and, therefore, neuroplasticity, which confers preventive and therapeutic benefits to mental health conditions, mainly depression and dementia.<sup>5</sup> One important factor fundamental to mitochondrial biogenesis (second-level cellular mechanism) is the induction of a transcription coactivator—PGC-1 $\alpha$  (peroxisome proliferator-activated receptor gamma coactivator 1- $\alpha$ ).<sup>6</sup> PGC-1 $\alpha$  is considered as the principal regulator for promoting anti-inflammatory and immunomodulatory effects implicated in

the positive effects of exercise in dementia and depression.<sup>6,7</sup> Depression, like diabetes mellitus, activates the nuclear factor kappa enhancer of activated B cells (NF-kB) signaling pathway, which leads to the release of proinflammatory cytokines interleukins 1 and 6 and, the tumor necrosis factor (TNF)- $\alpha$ . Exercise-related regulation of PGC-1 $\alpha$  inhibits the NF-kB pathway and therefore helps alleviate depression.<sup>7</sup> As the role of neuroinflammation has been implicated in various other neuropsychiatric illnesses,<sup>8,9</sup> similar neurobiological mechanisms may perhaps underlie the effects of exercise in them as well (see Figure 1 for physical-activity-led cellular events resulting in positive mental health effects).

### Physical Activity for the Prevention and Treatment of Mental Disorders

In those who are otherwise healthy, physical activity promotes sleep, sex, energy, stamina, endurance, self-esteem,

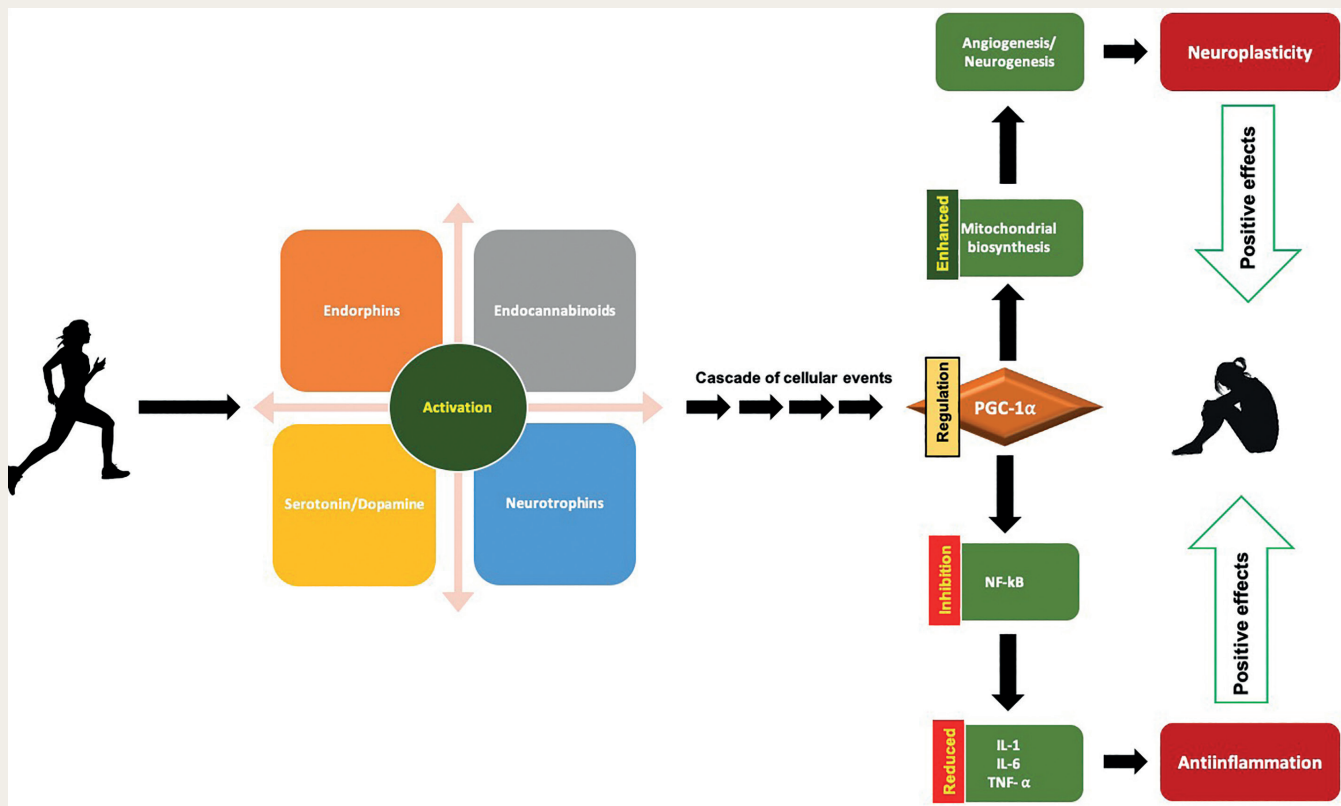
social interactions, and stress relief.<sup>10</sup> While effective in promoting several such positive mental health indicators, convincing evidence is also available for the role of physical activity in preventing dementia and depression and in the adjunctive treatment of depression, anxiety, substance use, and psychotic disorders.

### Prevention of Depression

A meta-analysis by Schuch et al.,<sup>11</sup> which included 49 prospective studies and a total sample of 2,66,939, found that people with higher levels of physical activity had lower odds of developing depression (adjusted odds ratio = 0.83) compared to those with lower levels; this protection against incident depression was regardless of age and geographical region. Importantly, across all levels of genetic vulnerability, even among individuals at the highest polygenic risk, higher levels of physical activity have been found to be associated with reduced odds of incident depression.<sup>12</sup>

FIGURE 1.

### Physical activity led cellular events resulting in positive mental health effects<sup>5,7</sup>



PGC-1 $\alpha$ : Peroxisome proliferator-activated receptor Gamma Coactivator 1- $\alpha$ ; NF-kB; Nuclear Factor Kappa enhancer of activated B cells; IL-Interleukin; TNF- $\alpha$ : Tumor Necrosis Factor- $\alpha$

## Prevention of Dementia

With respect to the benefits of physical activity in preventing dementia, the WHO has made two recommendations: (1) Physical activity *should* be recommended to adults with normal cognition to reduce the risk of cognitive decline (“moderate” quality of evidence and “strong” strength of recommendation), and (2) physical activity *may* be recommended to adults with mild cognitive impairment to reduce the risk of cognitive decline (“low” quality of evidence and “conditional” strength of recommendation).<sup>13,14</sup> These recommendations are based on the assumptions that around one-third of dementia cases are attributable to modifiable risk factors and that ‘what is good for the heart is considered good for the brain’.<sup>13,14</sup>

## Treatment of Psychiatric Disorders

There is highest level of evidence in the form of meta-analyses for the role of physical activity as a treatment strategy in psychiatric disorders. A recent meta-review, a review of meta-analyses, suggests that physical activity as an adjunct is effective in a range of diagnoses and helps speed up or enhance the benefits of the first-line treatment strategies.<sup>15</sup> **Table 1** lists important assertions from this meta-review and the corresponding number of supporting meta-analyses. The level of evidence available for treatment effects of physical activity for depression, schizophrenia, and anxiety disorders is considered as “1a,”<sup>16</sup> that is, presence of homogenous systematic reviews according to the Oxford Centre for Evidence-Based-Medicine

(CEBM) levels and accordingly receives a grade A recommendation. Evidence level of “1a” is also available for the positive adjunctive effect of physical activity in reducing the severity of mild cognitive impairment, Alzheimer’s dementia, substance dependence (alcohol and nicotine), and post-traumatic stress disorder<sup>16</sup> and, therefore, also receive grade A recommendation. While eating disorders such as anorexia, bulimia, and binge eating disorder have level “1b” evidence (individual randomized controlled trial (RCT) with a narrow confidence interval), the level of evidence for bipolar disorder and obsessive-compulsive disorder is only at the level of case series (level “4” evidence).<sup>16</sup>

It is obligatory to mention the role of physical activity in treating metabolic syndrome and weight gain, both of which are prominently associated with mental disorders and their treatment. Apart from direct benefits on psychiatric symptoms, physical activity also plays an important role in alleviating the transdiagnostic (and across classes of psychotropic drugs) risk for cardiometabolic disorders in psychiatry.<sup>15</sup> A review by Paley and Johnson<sup>17</sup> showed that a moderate amount of evidence is available that indicates that physical activity can indeed reverse metabolic syndrome. A recent meta-analysis also has found that lifestyle interventions that include physical activity can be used for weight reduction in serious mental illnesses.<sup>18</sup>

## Exercise Prescription: What Type of Physical Activity, Duration, and Frequency?

On the type, duration, and frequency of physical activity, the WHO has made

recommendations for “health” in general (**Table S1a**).<sup>19</sup> While for children (5–17 years of age), “60 minutes” of moderate to vigorous-intensity physical exercise “daily” is recommended, “150 minutes” of “moderate” or “75 minutes” of “vigorous” intensity “throughout the week” is recommended for adults (18 years and above) (**Table S1b** provides the definition and examples of moderate and vigorous-intensity activities). In this section, we discuss recommendations on the type, duration, and frequency of physical activity in mental health.

## Prevention of Depression

The meta-analysis by Schuch et al.<sup>11</sup> was not able to specify the optimal type of physical activity or the minimum or optimal dosage, due to the wide variation of these factors in the selected studies. A recent study,<sup>20</sup> conducted on a sample of 1.2 million individuals, found that the overall current mental health burden was significantly lower in those who participated in “any” physical activity than in those who did not. The optimal duration and frequency of physical activity that this study proposes are 45 minutes and 3–5 days a week, respectively. The same conclusions were true for those having an earlier diagnosis of depression as well, implying its role in relapse prevention. Intriguingly, the benefits of physical activity on mental health burden were shown to paradoxically reduce with an increase in the time or frequency beyond 45 minutes and 5 per week in this study. Another study, which found incident depression to be lower in those involved in physical activity despite the high genetic risk, also suggests that 45 minutes per day of additional physical activity on 5–6 days/week (a total of 4 hours/week) translates to a meaningful reduction in risk of depression.<sup>12</sup> Although any physical activity/exercise was better than no exercise, involvement in “popular sports” was much more strongly related to reduced mental health burden.<sup>20</sup> In the context of popular sports, Bohr et al.<sup>21</sup> studied a sample in excess of 10,000 individuals and found that involvement in contact sports, specifically football, during adolescence was associated with lower depression scores and suicidal ideation during adulthood. Across walking, jogging, running, biking, and low- and

TABLE 1.

### Role of Physical Activity as a Treatment Strategy in Various Psychiatric Diagnoses<sup>15</sup>

Sl.no	Conclusive Assertions	Number of Supporting Meta-analyses
1	Exercise reduces depression in children, adults, older adults	8
2	Exercise reduces anxiety symptoms	3
3	Exercise effective as adjunct in reducing positive/negative symptoms of schizophrenia	2
4	Exercise improves global cognitive function in schizophrenia	1
5	Exercise improves global cognitive function in children with ADHD	1

high-intensity training, there were significant correlations with each other in reducing the risk of depression,<sup>12</sup> implying any of these activities may be taken up.

## Prevention of Dementia

The WHO recommendations for health, in general,<sup>19</sup> are valid for the prevention of the cognitive decline in healthy as well as those with mild cognitive impairment. Specifically, “10 minutes twice a day” of moderate-intensity aerobic physical activities such as cycling, running, taking a pet for a stroll, etc., and resistance training “twice a week” are recommended.<sup>13-14</sup> Importantly, a proactive lifelong approach is recommended for dementia prevention.<sup>14</sup>

## Treatment of Psychiatric Disorders

There is no consensus on what type of physical activity and for what duration or frequency is more effective in treating psychiatric symptoms, due to heterogeneity regarding the frequency, intensity, type, and time of physical activity in various RCTs. By and large, the majority of RCTs that formed the recommendations for physical activity in various psychiatric disorders (depression, anxiety, schizophrenia, and attention deficit hyperactivity disorder (ADHD); see **Table 1**) involve endurance training—running and cycling, 30-minute sessions, 3 times a week, for 8–12 weeks.<sup>16</sup> The European Psychiatric Association (EPA), however, has made certain specific clinical practice recommendations on the type, duration, and frequency of physical activity in the treatment for severe mental illnesses (SMI)<sup>22</sup>:

1. Mild-moderate depression: 2–3 sessions per week of 45–60 minutes of moderate-intensity mixed physical activity (i.e., aerobic and/or anaerobic and resistance training).
2. Schizophrenia: 150 minutes/week of moderate to vigorous aerobic exercise. Further, there are no clear recommendations for the use of a specific type, frequency, or duration of physical activity in reversing psychotropic-related metabolic syndrome and weight gain as well. Higher intensity interval training (HIIT), which include short (about 10 minutes) bursts of vigorous-intensity

activities, is specifically beneficial in metabolic syndrome.<sup>17</sup>

## Challenges for the Exercise Prescription and Strategies to Tackle

Apart from a variety of reasons such as the physical make-up of the individual, age, gender, and comorbid conditions, such as coronary artery disease and osteoarthritis, low exercise motivation can be a significant hindrance to initiating and maintaining physical activity as a preventive/therapeutic strategy. Therefore, motivational interviewing principles have been recommended to motivate individuals/patients to take up physical activity.<sup>15</sup> Moreover, motivational interviewing might also help tackle illness factors associated with psychiatric diagnoses, such as anhedonia, lack of energy, and amotivation.<sup>23</sup>

Due to all these factors, both physical and psychological, one may not readily achieve the recommended intensity, duration, and frequency of physical activity. This is where graded programs will be helpful. ‘Graded’ programs are characterized by “establishment of a baseline of achievable exercise or physical activity, followed by a negotiated, incremental increase in the duration of time spent physically active, followed by an increase in intensity.”<sup>24</sup> Certain ‘aided’ strategies have also been recommended to cross these hurdles. As standard physical activities may be too demanding, low-threshold interventions, like step counting using fitness trackers, can be used. Absolute moderate-intensity physical activity translates to 3,000 steps in 30 minutes.<sup>25</sup> Moderate to vigorous-intensity physical activity constitute 3,000–6,000 steps.<sup>26</sup> Important here is to note that the popular recommendation of 10,000 daily steps is specifically valid in the context of reducing cardiovascular event rates, and this target is associated adversely with the risk of developing osteoarthritis.<sup>26</sup> It is also important to mention here that along with osteoarthritis and other musculoskeletal disorders, the risk of coronary artery disease and the presence of imbalance due to any reason have been identified as realistic concerns for promoting physical activity in SMIs.<sup>27</sup> Another aided strategy is incorporating physical activity into cognitive behavioral strategies like behavioral activation.<sup>28</sup> This strategy has been found

to have strong credibility and better completion rates than physical activity alone and is particularly effective when standard physical activity schedules are deemed monotonous. In fact, behavioral activation, in conjunction with physical activity, has been found to have the potential to reverse immunological alterations in depression, such as increasing the levels of anti-inflammatory cytokine IL-10.<sup>29</sup>

The EPA<sup>22</sup> recommends that physical activity as a treatment in SMI be supervised by an exercise specialist, that is, the physical activity has to be ‘guided’. This has been deemed important for optimal outcomes and better compliance. These may be particularly important in patients with inattention, distractibility, or impulsivity, such as in those with mania or ADHD. The same principle might be used for the use of physical activity in mental health in general, not just for treatment. Apart from graded and aided strategies, we also deem that the physical activity has to be guided, wherever possible, to tackle various challenges.

There are ambitious attempts to develop an “exercise pill,” which may be prescribed to individuals, especially the elderly, who are incapable of the minimum required physical activity that will reap cognitive benefits. Very recently, Horowitz et al.<sup>30</sup> conducted an animal experiment in which the glycosylphosphatidylinositol (GPI)—specific phospholipase D1 (Gpld1) rich plasma, extracted from young mice soon after exercise and found to be correlated with improved cognitive functions, was transferred to old mice and found significant cognitive benefits. Moreover, whole-body vibration exercise is already being studied as a replacement for physical activity in certain health conditions.<sup>31</sup>

## Relevance to India

The Government of India launched the “Fit India” movement, with the slogan “Get Fitter. Healthier. Happier,” in August 2019.<sup>32</sup> This movement has been based on the premise that Indians are far more physically inactive than the global population. In India, 54.4% (41% of males and 59.6% of females) are physically “inactive”<sup>33</sup>; these rates are two times the global rates of “insufficient physical activity.”<sup>2</sup> The rates of physical inactivity in Indian children (aged 11–17

years), that is, 73.9%, was better than the corresponding global rates of 81.0%.<sup>34</sup> However, it has been found that the rates of “no recreational physical activity” in India increases as the age increases (86.7% in 20–29 years to 95.9% in >65 years).<sup>33</sup> The “Fit India” campaign adapts the recommendations from WHO and recommends 30–60 minutes per day of physical activity.

Albeit a smaller number of available studies, evidence from India too supports the recommendations for the use of physical activity in various mental illnesses. Recently, a review of Indian studies (both cross-sectional and interventional)<sup>35</sup> on the role of physical activity in mental health found physical activity to improve clinical outcomes in both common and severe mental disorders. On the specific kind of physical activity and in the context of popular and contact sports being better in terms of lesser rates of mental health burden, depression, and suicidal ideation,<sup>20,21</sup> indigenous sports like kabaddi might be recommended. In India, popular sports might vary from region to region, and the “Fit India” provides the list of these popular sports.<sup>32</sup>

Coming to the challenges, “lack of time,” and “lack of motivation” are the most important factors affecting the lack of physical activity in India.<sup>36</sup> These factors might be held responsible for the “staggering” difference between Indian and global levels of physical inactivity.<sup>2,33</sup> Understandably, the inability to find time for physical activity is due to the busy work schedule for those in job/business. However, women who are homemakers too find it difficult to find the time. Although household chores are considered moderate-intensity physical activity, it is important to assert that the recommended duration of physical activity in the “mental health prescription” should be “over and above” the usual routine activity. Therefore, the recommended use of motivational interviewing principles to motivate individuals/patients to find time and take up physical activity<sup>15</sup> becomes very important in Indian clients.

Cultural and family values also contribute to the low levels of physical activity in Indians. In general, “encouragement from significant others” in the family is the strongest sociocultural

determinants of higher levels of physical activity.<sup>37</sup> For Indians, especially girls and women, this determinant is not available to a large extent<sup>36</sup> due to cultural sanctions (this has been depicted in the Bollywood movie “Dangal”). In this context, family-oriented physical activity interventions where parents are invited to encourage and play with children have been proposed for improving physical activity levels in children.<sup>38</sup> Further, most physical activity in Indian children happens in the context of school (including transportation), and only 30% of families have been found to participate with children in any physical activity.<sup>39</sup> More parents should be motivated to involve children in out-of-school physical activities. The National Health Portal, India, identifies “fewer opportunities for access to safe places” and “fear of violence and crime in outdoor areas” as factors discouraging physical activity among Indians.<sup>40</sup> Apart from the cultural and family factors, these issues also lead to a lack of “encouragement from significant others,” especially for women. Hence ensuring the safety of outdoor parks and grounds is very important.

## Yoga and Physical Activity

India being the land of yoga, its role as a means of physical activity in mental health needs a special mention. Given the lack of motivation for effort and the relatively lesser efforts needed in yoga,<sup>41</sup> it can be an alternate means for physical activity for Indian clients. In fact, most Indian studies evaluating the efficacy of physical activity in psychiatric disorders involve yoga programs as a comparator (rather vice versa).<sup>35</sup> Reviewing and comparing these two strategies, Govindaraj et al.<sup>42</sup> show that yoga is equal to or superior to exercise in most outcomes, not only related to mental health but also general health, including cardiovascular, reproductive, musculoskeletal, endocrine, etc. In fact, a recent review by Mohanty et al.<sup>43</sup> recommends the compendium of physical activities to add a separate category for energy expenditure by yoga; they found that yoga, in terms of energy expenditure, is equivalent to moderate intensity physical activity. The review by Govindaraj et al.,<sup>42</sup> however, points to the common but inaccurate notion

that “yoga is a form of exercise” and lists important differences between them that are mainly attributable to yoga, which includes “emphasis on breath regulation, mindfulness during practice, the importance given to the maintenance of postures and differential effects on the body and the brain.” We suggest studies examining preventive and therapeutic physical activity schedules to combine yoga and other customary forms of physical activity to assess whether the benefits are additive.

## The Conundrum of COVID-19 Pandemic—Relevance to Mental Health and Physical Activity

Any discussion during the current times is incomplete without mentioning the relevance in the context of the COVID-19 pandemic. The pandemic has had an alarming effect on global mental health. Therefore, maintaining adequate levels of physical activity may be beneficial during these times. However, pandemic-led restrictions, such as social isolation and compulsory donning of face masks when outdoors, have badly affected the routine modes of physical activities too. The WHO’s campaign “healthy at home”<sup>44</sup> has recommended certain strategies to remain physically active and maintain recommended levels of physical activity. These are walking up and down the stairs; stretching exercises, dancing to music, and seeking more ideas and resources online. Online strategies such as eMotion—an online Intervention using behavioral activation and physical activity for persons with depression,<sup>45</sup> might be useful and need to be assessed systematically. Intriguingly, the pandemic-led restrictions have led to negative mental health consequences in sportspersons too, due to detraining. Minimalistic physical training in the form of plyometric exercises (jump training) and tele-workouts, as well as maintaining social connectedness, which is akin to behavioral activation, have been recommended to deal with them.<sup>46</sup>

Various strategies and corresponding challenges that they aim to tackle in improving physical activity outcomes are presented in **Table 2**.

TABLE 2.

**Suggested Strategies for Improving Physical Activity Outcomes**

S.no	Strategies	Challenges
1	Motivational interviewing	<ul style="list-style-type: none"> <li>• Low exercise motivation</li> <li>• Where lack of time is considered a hindrance</li> <li>• Illness factors such as anhedonia, lack of energy and amotivation</li> <li>• To improve family participation and encouragement</li> </ul>
2	Graded programmes	<ul style="list-style-type: none"> <li>• Comorbid physical conditions—coronary artery disease and osteoarthritis</li> <li>• Imbalance, which may be due to effect of psychotropic</li> <li>• Low exercise motivation</li> </ul>
3	Fitness aids	<ul style="list-style-type: none"> <li>• Low exercise motivation</li> <li>• Comorbid conditions due to which standard physical activities may be deemed too demanding</li> </ul>
4	Behavioural activation	<ul style="list-style-type: none"> <li>• Low adherence due to monotonous nature of the schedule</li> <li>• Illness factors such as anhedonia, lack of energy and amotivation</li> </ul>
5	Supervised/guided programmes	<ul style="list-style-type: none"> <li>• Low adherence due to any reason</li> <li>• Severe mental illnesses</li> <li>• To improve family participation and encouragement</li> </ul>
6	Yoga and minimalistic training	<ul style="list-style-type: none"> <li>• Low exercise motivation</li> <li>• Comorbid conditions due to which standard physical activities may be deemed too demanding</li> <li>• Lack of opportunity for outdoor activities</li> </ul>

**Conclusion**

With the rates of physical inactivity in India being two times that of the global rates, achieving the proposed 15% reduction in these rates by 2030 will be a huge challenge. Prescribing physical activity for mental health by we mental health professionals might contribute significantly in achieving the goals set by the GAPP. The adjunctive role of physical activity in the prevention and treatment of various mental health conditions has gathered significant positive evidence. Therefore, including physical activity in our prescription might help bring down the rates of the current prevalence of mental illnesses in India, which, too, pose an immense challenge. An important by-product of enhancing our skills in the implementation of physical activity, exercise, and sports in the prevention and treatment of mental disorders might as well see the growth of a subspecialty in our discipline—sports psychiatry.<sup>16</sup>

**Author Disclosure**

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**References**

1. World Health Organization. *Global action plan on physical activity 2018–2030*. WHO: Geneva, 2020. <https://apps.who.int/iris/bitstream/handle/10665/272721/WHO-NMH-PND-18.5-eng.pdf?ua=1> (assessed August 5, 2020).
2. Guthold R, Stevens GA, Riley LM, et al. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1.9 million participants. *Lancet Glob Health* 2018; 6: e1077–e1086.
3. Wagemaker H and Goldstein L. The runner's high. *J Sports Med Phys Fitness* 1980; 20: 227–229.
4. Hicks SD, Jacob P, Perez O, et al. The transcriptional signature of a runner's high. *Med Sci Sports Exerc* 2019; 51: 970–978.
5. Matta Mello Portugal E, Cevada T, Sobral Monteiro-Junior R, et al. Neuroscience of exercise: from neurobiology mechanisms to mental health. *Neuropsychobiology* 2013; 68: 1–14.
6. Austin S and St-Pierre J. PGC1 $\alpha$  and mitochondrial metabolism—emerging concepts and relevance in ageing and neurodegenerative disorders. *J Cell Sci* 2012; 125: 4963–4971.
7. Phillips C and Fahimi A. Immune and neuroprotective effects of physical activity on the brain in depression. *Front Neurosci* 2018; 12: 498.
8. Najjar S, Pearlman DM, Alper K, et al. Neuroinflammation and psychiatric illness. *J Neuroinflammation* 2013; 10: 43.
9. Sethi R, Gómez-Coronado N, Walker AJ, et al. Neurobiology and therapeutic potential of cyclooxygenase-2 (COX-2) inhibitors for inflammation in neuropsychiatric disorders. *Front Psychiatry* 2019; 10: 605.
10. Sharma A, Madaan V, and Petty FD. Exercise for mental health. *Prim Care Companion J Clin Psychiatry* 2006; 8: 106.
11. Schuch FB, Vancampfort D, Firth J, et al. Physical activity and incident depression: a meta-analysis of prospective cohort studies. *Am J Psychiatry* 2018; 175: 631–648.
12. Choi KW, Zheutlin AB, Karlson RA, et al. Physical activity offsets genetic risk for incident depression assessed via electronic health records in a biobank cohort study. *Depress Anxiety* 2020; 37: 106–114.
13. World Health Organization. *Risk reduction of cognitive decline and dementia. WHO guidelines*. Geneva: WHO, 2019.
14. Alty J, Farrow M, and Lawler K. Exercise and dementia prevention. *Pract Neurol* 2020; 20: 234–240.
15. Ashdown-Franks G, Firth J, Carney R, et al. Exercise as medicine for mental and substance use disorders: a meta-review of the benefits for neuropsychiatric and cognitive outcomes. *Sports Med* 2020; 50: 151–170.

16. Ströhle A. Sports psychiatry: mental health and mental disorders in athletes and exercise treatment of mental disorders. *Eur Arch Psychiatry Clin Neurosci* 2019; 269: 485–498.
17. Paley CA and Johnson MI. Abdominal obesity and metabolic syndrome: exercise as medicine? *BMC Sports Sci Med Rehabil* 2018; 10: 7.
18. Speyer H, Jakobsen AS, Westergaard C, et al. Lifestyle interventions for weight management in people with serious mental illness: a systematic review with meta-analysis, trial sequential analysis, and meta-regression analysis exploring the mediators and moderators of treatment effects. *Psychother Psychosom* 2019; 88: 350–362.
19. World Health Organization. *Global recommendations on physical activity for health*. Geneva: WHO, 2010. [https://apps.who.int/iris/bitstream/handle/10665/44399/9789241599979\\_eng.pdf?sequence=1](https://apps.who.int/iris/bitstream/handle/10665/44399/9789241599979_eng.pdf?sequence=1) (assessed August 5, 2020).
20. Chekroud SR, Gueorguieva R, Zheutlin AB, et al. Association between physical exercise and mental health in 1.2 million individuals in the USA between 2011 and 2015: a cross-sectional study. *Lancet Psychiatry* 2018; 5: 739–746.
21. Bohr AD, Boardman JD, and McQueen MB. Association of adolescent sport participation with cognition and depressive symptoms in early adulthood. *Orthop J Sports Med* 2019; 7: 2325967119868658.
22. Stubbs B, Vancampfort D, Hallgren M, et al. EPA guidance on physical activity as a treatment for severe mental illness: a meta-review of the evidence and Position Statement from the European Psychiatric Association (EPA), supported by the International Organization of Physical Therapists in Mental Health (IOPTMH). *Eur Psychiatry* 2018; 54: 124–144.
23. Choi KH, Jaekal E, and Lee GY. Motivational and behavioral activation as an adjunct to psychiatric rehabilitation for mild to moderate negative symptoms in individuals with schizophrenia: a proof-of-concept pilot study. *Front Psychol* 2016; 7: 1759.
24. Larun L, Brurberg KG, Odgaard-Jensen J, et al. Exercise therapy for chronic fatigue syndrome. *Cochrane Database Syst Rev* 2019; 10: CD003200.
25. Marshall SJ, Levy SS, Tudor-Locke CE, et al. Translating physical activity recommendations into a pedometer-based step goal: 3000 steps in 30 minutes. *Am J Prev Med* 2009; 36: 410–415.
26. Kraus WE, Janz KF, Powell KE, et al. Daily step counts for measuring physical activity exposure and its relation to health. *Med Sci Sports Exerc* 2019; 51: 1206–1212.
27. Hamera E, Goetz J, Brown C, et al. Safety considerations when promoting exercise in individuals with serious mental illness. *Psychiatry Res* 2010; 178: 220–222.
28. Szuhany KL and Otto MW. Efficacy evaluation of exercise as an augmentation strategy to brief behavioral activation treatment for depression: a randomized pilot trial. *Cogn Behav Ther* 2020; 49: 228–241.
29. Euteneuer F, Dannehl K, Del Rey A, et al. Immunological effects of behavioral activation with exercise in major depression: an exploratory randomized controlled trial. *Transl Psychiatry* 2017; 7: e1132.
30. Horowitz AM, Fan X, Bieri G, et al. Blood factors transfer beneficial effects of exercise on neurogenesis and cognition to the aged brain. *Science* 2020; 369: 167–173.
31. Bidonde J, Busch AJ, van der Spuy I, et al. Whole body vibration exercise training for fibromyalgia. *Cochrane Database Syst Rev* 2017; 9: CD011755.
32. Ministry of Youth Affairs and Sports, Government of India, and Sports Authority of India. *Fit India*. New Delhi: SAI, 2020. <https://fitindia.gov.in> (assessed August 5, 2020).
33. Anjana RM, Pradeepa R, Das AK, et al. Physical activity and inactivity patterns in India—results from the ICMR-INDIAB study (Phase-1) [ICMR-INDIAB-5]. *Int J Behav Nutr Phys Act* 2014; 11: 26.
34. Guthold R, Stevens GA, Riley LM, et al. Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1.6 million participants. *Lancet Child Adolesc Health* 2020; 4: 23–35.
35. Cherubal AG, Suhavana B, Padmavati R, et al. Physical activity and mental health in India: a narrative review. *Int J Soc Psychiatry* 2019; 65: 656–667.
36. Shettigar S, Shivaraj K, and Shettigar S. A study to assess the factors affecting adherence to exercise in the Indian population. *Cureus* 2019; 11: e6062.
37. Jaeschke L, Steinbrecher A, Luzak A, et al. Socio-cultural determinants of physical activity across the life course: a “determinants of diet and physical activity” (DEDIPAC) umbrella systematic literature review. *Int J Behav Nutr Phys Act* 2017; 14: 173.
38. Ramanathan S and Crocker PR. The influence of family and culture on physical activity among female adolescents from the Indian diaspora. *Qual Health Res* 2009; 19: 492–503.
39. Bhawra J, Chopra P, Harish R, et al. Results from India’s 2018 report card on physical activity for children and youth. *J Phys Act Health* 2018; 15: S373–S374.
40. National Health Portal. *Physical activity*. New Delhi: National Health Portal, 2020. <https://www.nhp.gov.in/healthyliving/physical-activity> (assessed September 5, 2020).
41. Steele J, Fisher J, Skivington M, et al. A higher effort-based paradigm in physical activity and exercise for public health: making the case for a greater emphasis on resistance training. *BMC Public Health* 2017; 17: 300.
42. Govindaraj R, Karmani S, Varambally S, et al. Yoga and physical exercise—a review and comparison. *Int Rev Psychiatry* 2016; 28: 242–253.
43. Mohanty S, Epari V, and Yasobant S. Can yoga meet the requirement of the physical activity guideline of India? A descriptive review. *Int J Yoga* 2020; 13: 3–8.
44. World Health Organization. *#HealthyAtHome—physical activity*. Geneva: WHO, 2020. <https://www.who.int/news-room/campaigns/connecting-the-world-to-combat-coronavirus/healthyathome/healthyathome--physical-activity> (assessed August 5, 2020).
45. Lambert JD, Greaves CJ, Farrand P, et al. Web-based intervention using behavioral activation and physical activity for adults with depression (the eMotion study): pilot randomized controlled trial. *J Med Internet Res* 2018; 20: e10112.
46. Kizhakkekara JS, Joseph SJ, and Gowda GS. Psychological ramifications of detraining effects in sportspersons amidst the COVID-19 pandemic: a consensus compendium [published online August 7, 2020]. *Open J Psychiatry Allied Sci*. DOI: 10.5958/2394-2061.2021.00008.2