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ORIGINAL ARTICLE

The association between medical fitness facility attendance and incident mental disorders

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Abstract

Objective This study examined the effects of medical fitness facility (MFF) attendance, a proxy for exercise, on the incidence of mental disorders.

Methods This retrospective cohort study linked members at two MFFs in Winnipeg, Canada, to health administrative databases held at the Manitoba Centre for Health Policy population research data repository. Adults aged ≥ 18 years were assigned an index date at MFF membership enrollment between January 1, 2005, and December 31, 2015, and matched to controls based on propensity score weighting. Cox proportional hazards models generated hazard ratios (HR) comparing the MFF group to controls on incident mental disorders (mood and anxiety disorders, substance use disorders, dementia, personality disorders, schizophrenia, and psychotic disorders).

Results There were 15,407 MFF members and 507,400 controls. Attendance at a MFF was associated with a reduced hazards risk of incident substance use disorders (HR = 0.67, 95% confidence interval (CI) 0.62–0.67), psychotic disorders (HR = 0.69, 95% CI 0.60–0.79), personality disorders (HR = 0.63, 95% CI 0.50–0.78), schizophrenia (HR = 0.69, 95% CI 0.52–0.93), and dementia (HR = 0.69, 95% CI 0.64–0.75).

Conclusion Attending a medical fitness facility was associated with a reduced risk of incident mental disorders. Further research in MFFs as preventive initiatives for mental illness is warranted.

Résumé

Objectif Cette étude a examiné les effets de la fréquentation d'un centre médical de conditionnement physique (MCP), un indicateur de l'exercice, sur l'incidence des troubles mentaux.

Méthodes Cette étude de cohorte rétrospective a relié les membres de deux MCP à Winnipeg, au Canada, à des bases de données administratives sur la santé conservées au référentiel de données de recherche démographique du Centre manitobain pour les politiques de santé. Les adultes âgés de ≥ 18 ans se sont vu attribuer une date d'indexation lors de l'adhésion au MCP

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entre le 1er janvier 2005 et le 31 décembre 2015 et ont été appariés à des contrôles sur la base de la pondération du score de propension. Les modèles à risques proportionnels de Cox ont généré des rapports de risque (RR) comparant le groupe MCP aux témoins sur les troubles mentaux incidents (troubles de l'humeur et d'anxiété, troubles liés à l'usage de substances, démence, troubles de la personnalité, schizophrénie et troubles psychotiques).

Résultats Il y avait 15 407 membres du MCP et 507 400 témoins. La fréquentation d'un MCP était associée à un risque réduit de troubles liés à l'usage incident de substances [RR = 0,67, intervalle de confiance (IC) à 95% 0,62–0,67], de troubles psychotiques (RR = 0,69, IC à 95% 0,60–0,79), de troubles de la personnalité (RR = 0,63, IC à 95% 0,50–0,78), la schizophrénie (RR = 0,69, IC à 95% 0,52–0,93) et la démence (RR = 0,69, IC à 95% 0,64–0,75).

Conclusion La fréquentation d'un centre MCP était associée à un risque réduit de troubles mentaux incidents. Des recherches plus approfondies sur les centres de conditionnement physique médicaux en tant qu'initiatives préventives contre la maladie mentale sont justifiées.

Keywords Mental disorders · Exercise · Prevention · Population health

Mots-clés Troubles mentaux · Exercice · Prévention · Santé de la population

Introduction

It is estimated that 20% of Canadians live with a mental illness. Mental disorders are associated with adverse health outcomes, including disability, morbidity, suicide, and mortality (Chartier et al., 2018). In Canada, mental disorders result in costs of over $50 billion per year (Smetanin et al., 2011). Various strategies have been proposed for the prevention of mental disorders; one of these strategies has been physical exercise.

The association between exercise and mental illness is complex and multifaceted. There are a range of activities that can be considered exercise, and these may be measured objectively or reported subjectively. Similarly, mental illness encompasses a range of very different disorders, whose presence, absence, or severity is ascertained by a variety of approaches, including surveys, scales, self-report, and physician diagnoses. Exercise has been studied as an approach to prevent depression in adults (Min et al., 2013). Meta-analyses have demonstrated a dose–response relationship for exercise for both primary prevention and treatment of major depression (Hu et al., 2020; Noetel et al., 2024; Pearce et al., 2022). Evidence also exists supporting exercise as a preventive factor for dementia (Santos-Lozano et al., 2016). One meta-analysis of observational studies totaling 23,000 participants examining the effects of exercise on incidence of dementia found an odds ratio of 0.65, suggesting a protective effect (Santos-Lozano et al., 2016). Another meta-analysis found a linear dose–response relationship between exercise and reduced risk of dementia, where every 500 kcal per week resulted in a 10% decrease in risk (Xu et al., 2017). Mixed findings have been reported in systematic reviews and meta-analyses of studies examining the association between physical exercise and anxiety disorders (McDowell et al., 2019; Moreno-Peral et al., 2022). A meta-analysis of randomized controlled trials (RCTs) looking at effects of objective and self-reported exercise on incidence of anxiety disorders found no benefit of exercise. The authors noted that the quality of included studies was low and there was a small sample size of 350 people (Moreno-Peral et al., 2022). A meta-analysis of 13 prospective cohort studies looking at anxiety symptoms as well as incidence after exercise exposure found a significant protective effect for generalized anxiety disorder. However, there were issues with exposure and outcome measures in several of their included studies (McDowell et al., 2019). In another meta-analysis, significant reductions in incidence were found for agoraphobia and post-traumatic stress disorder (PTSD) but not for other anxiety disorders (Schuch et al., 2019).

Exercise has been much less studied in other mental disorders, specifically substance use disorders, psychotic disorders, and personality disorders. In these conditions, exercise has more commonly been studied as an intervention among people with existing mental illness, rather than the prevention of development of incident illness. In the case of substance use disorders, it has improved rates of abstinence and showed benefit in withdrawal symptoms (Wang et al., 2014). One meta-analysis included 59 studies of varying methodology with a broad definition of exercise, including yoga, tai chi, and other modalities in addition to aerobic exercise. They found positive effects on cravings, but only for aerobic exercise, and results were inconsistent for abstinence (Giménez-Meseguer et al., 2020). A systematic review of 44 studies examining the effects of various interventions specifically on methamphetamine use disorder included 4 studies that considered exercise. These studies showed benefits for cravings with a dose–response relationship for exercise intensity and duration. There was a trend toward improved abstinence but this was not statistically significant (Asharani et al., 2020). A recent meta-analysis examining physical exercise and substance use disorders showed very few studies

that focused on the prevention of incident disorders; none examined adults, and none focused on the risk of both drug and alcohol use disorders (Thompson et al., 2020). The literature on exercise and psychotic disorders is fairly sparse with mixed findings. While some benefits have been reported with exercise as an intervention among people with schizophrenia (Keller-Varady et al., 2018), self-reported exercise was not protective against incident psychotic disorders in a meta-analysis that adjusted for confounding factors (Brokmeier et al., 2020). For personality disorders, no RCTs, systematic reviews, or meta-analyses were found assessing the effects of exercise on incidence or symptom management.

An exercise-based intervention that has shown benefit in reducing mortality and all-cause hospitalizations is the use of medical fitness facilities (MFFs) (Brar et al., 2021). These facilities are geared toward the prevention of adverse health conditions. They differ from regular fitness facilities in that they strictly adhere to certain guidelines, such as having medical oversight, certified staff, action plans for medical emergencies, disease management and prevention programs, as well as outcome tracking. An initial health risk assessment allows staff to determine the baseline health status of members and develop a corresponding exercise plan. Facilities are equipped with a variety of exercise equipment for strength training, aerobic exercise, balance, and flexibility as well as scheduled classes geared toward different subpopulations, such as aqua fitness for arthritis.

In summary, existing literature demonstrates in general that exercise shows many benefits for mental disorders. However, there are a few limitations with some of this work, including reliance on self-reported physical exercise, a range of study designs, and a limited literature in certain mental disorders. There are no studies to our knowledge that have examined whether physical exercise is associated with a reduction in the development of incident drug and alcohol use disorders, and personality disorders. The present study aims to overcome these limitations by using objectively recorded attendance at MFFs and linking this information to administrative health and social databases in a population-based data repository. In so doing, we aim to examine the association between facility attendance and the incidence of a range of physician-diagnosed mental disorders among people with no history of mental illness.

Methods

Data sources

Data for the study were gathered from two sources: the Manitoba Centre for Health Policy (MCHP) population research data repository and the two MFFs in Winnipeg. The repository database contains linkable health and social data for almost all residents in Manitoba. Supplementary Table 1 provides a description of the databases accessed for this study. All information in the MCHP database is de-identified but can be linked to other databases via a scrambled coded identifier that is generated from a patient's personal health identification number (PHIN). Data on age and sex were retrieved from the provincial health registry data source; income is a proxy derived from national Census data. Income is based on average household income within the person's postal code of residence. The MFFs collected PHINs, date of birth, sex, and postal code, which were used in the linkage to the MCHP data repository by Manitoba Health. Attendance at these facilities was recorded by swipe access upon entry, allowing the ascertainment of facility use. These data sources and linkage have been previously described (Brar et al., 2021).

This study was approved by the University of Manitoba Health Research Ethics Board (HS19825 [H2016:224]) and the Health Information Privacy Committee (2017/2018–04).

Study population and design

A retrospective cohort study design was used to compare members who attended either of the two MFFs in Winnipeg, Manitoba, Canada, to propensity-weighted general population controls between January 1, 2005, and December 31, 2015. There are only two MFFs in Winnipeg, and since both were included in this study, people not in the MFF database could be confirmed as unexposed controls. The MFF group included new registered members from either of the two MFFs. Controls were identified through linked provincial health registries, which capture all individuals obtaining health services in Canada's single-payer universal health system. MFF membership was open to the general public and could be accessed by participants via self-referral, online or in person, or through referral by their health care provider. The study cohort is described in Fig. 1. Both groups included adults ($\geq$ 18 years) who resided in Winnipeg, Canada. Members from the MFFs were included from the introduction of the facility scanning systems (January 1, 2005, for one MFF and August 1, 2006, for the second). Members were assigned an index date based on their membership start date. Controls were registered with the provincial health insurance registry and assigned a pseudo-index date based on the time difference between start and end dates in the MFF group. The frequency distributions of time were applied at random to controls (Rocque et al., 2017). Participants in the control group were excluded if they had less than 1 year of continuous health coverage prior to the index date, if they had duplicate entries in the health registry, or if they didn't have a postal code (which was used to assign SES). Participants from both groups were excluded if they had a pre-existing

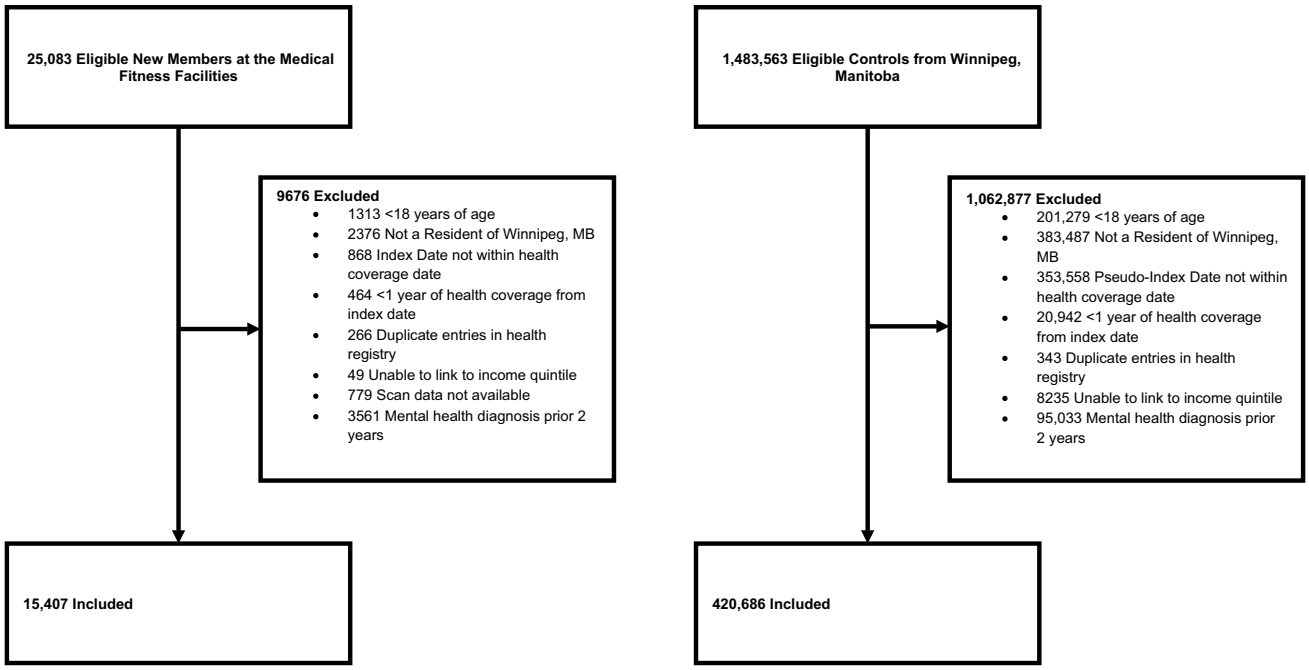

Fig. 1 Flow diagram showing cohort formation for medical fitness facility members and controls

mental health diagnosis within 2 years prior to index date, based on definitions using International Classification of Diseases (ICD)-9-CM and ICD-10-CA codes (Supplementary Table 2). Individuals were censored at the first occurrence of any of the following: the time of outcome (first diagnosis of a mental disorder), the end of the study period, or loss to follow-up. Individuals were considered lost to follow-up if they moved away from the province or had their health coverage terminated for unknown reasons.

Outcomes

The primary outcome was diagnosis of an incident mental disorder during the study period. The categories of mental disorders included were mood and anxiety disorders, substance use disorders, dementia, personality disorders, schizophrenia, and psychotic disorders. Definitions are found in Supplementary Table 2.

Statistical analysis

Baseline sociodemographic and clinical characteristics were presented by MFF membership status, with categorical variables presented as frequencies and percentages, and continuous variables as means and standard deviations (SDs) (Table 1). A predicted probability (propensity score) of being assigned to the MFF group was developed using a logistic regression model that incorporated age, sex, income quintile, index year, and comorbidities (definitions of comorbid conditions found in Supplementary Table 3) (Spreeuwenberg et al., 2010). Propensity scores were then used to estimate the treatment effect by the inverse probability treatment weighting (IPTW) adjustment method (Austin, 2011; Austin & Stuart, 2017). To account for extreme weights, stabilized weights were used (Austin & Stuart, 2015; Xiao et al., 2013). Balance in covariates between groups was assessed using the standardized mean difference (SMD) before and after IPTW, with a balanced covariate having SMD < 0.1 after IPTW (see Supplementary Table 4) (Austin, 2009; Flury & Riedwyl, 1986). The association of MFF attendance with a diagnosis of a new mental disorder was analyzed with Cox proportional hazards models. Schoenfeld residuals were plotted against rank failure times to determine any violation of the proportional hazards assumption with visual inspection. Given the high event rate of mood and anxiety disorders from primary care outpatient claims, a sensitivity analysis was included that was restricted to hospitalizations for mood and anxiety disorders, to investigate more severe outcomes.

Results

There were 15,407 members who attended an MFF and 420,686 controls (Fig. 1). The baseline characteristics of study participants can be found in Table 1. In the original

Table 1 Baseline characteristics of study participants before and after stabilized IPTW

	Unweighted		Stabilized IPTW	
	Controls	Members	Controls	Members
N	420,686	15,407	420,702.0	15,378.7
Covariates				
Age, mean (SD)	46.7 (18.1)	46.1 (17.6)	46.7 (18.1)	46.8 (17.4)
Male sex, *n* (%)	213,306 (50.7)	7499 (48.7)	213,006.0 (50.6)	7620.7 (49.6)
Previous diagnosis of, *n* (%)				
Myocardial infarction	8380 (2.0)	581 (3.8)	8647.6 (2.1)	330.8 (2.2)
Congestive heart failure	10,105 (2.4)	346 (2.3)	10,083.2 (2.4)	403.8 (2.6)
Peripheral vascular disease	10,947 (2.6)	427 (2.8)	10,974.3 (2.6)	425.5 (2.8)
Cerebrovascular disease	15,292 (3.6)	619 (4.0)	15,350.2 (3.7)	571.6 (3.7)
COPD	22,799 (5.4)	761 (4.9)	22,729.8 (5.4)	864.9 (5.6)
Connective tissue disease	12,486 (3.0)	504 (3.3)	12,532.7 (3.0)	475.4 (3.1)
Peptic ulcer disease	10,563 (2.5)	325 (2.1)	10,503.7 (2.5)	374.4 (2.4)
Diabetes	45,054 (10.7)	1784 (11.6)	45,187.4 (10.7)	1694.2 (11.0)
Chronic kidney disease	6530 (1.6)	217 (1.4)	6509.7 (1.6)	264.9 (1.7)
Cancer	27,363 (6.5)	1201 (7.8)	27,558.6 (6.6)	1037.4 (6.7)
Metastatic carcinoma	2870 (0.7)	110 (0.7)	2875.3 (0.7)	120.4 (0.8)
Cirrhosis	15,032 (3.6)	583 (3.8)	15,064.6 (3.6)	552.1 (3.7)
Hypertension	119,550 (28.4)	5069 (32.9)	120,222.0 (28.6)	4389.8 (28.5)
Coronary artery disease	30,198 (7.2)	1489 (9.7)	30,572.0 (7.3)	1141.8 (7.4)
Index year, *n* (%)				
Index year 2005	29,817 (7.1)	1193 (7.7)	29,917.9 (7.1)	1134.5 (7.4)
Index year 2006	40,254 (9.6)	1597 (10.4)	40,370.8 (9.6)	1414.2 (9.2)
Index year 2007	43,548 (10.4)	1704 (11.1)	43,653.9 (10.4)	1565.3 (10.2)
Index year 2008	38,137 (9.1)	1413 (9.2)	38,155.5 (9.1)	1421.2 (9.2)
Index year 2009	44,336 (10.5)	1646 (10.7)	44,357.5 (10.5)	1599.7 (10.4)
Index year 2010	38,322 (9.1)	1422 (9.2)	38,343.4 (9.1)	1445.1 (9.4)
Index year 2011	36,597 (8.7)	1318 (8.6)	36,577.3 (8.7)	1347.6 (8.8)
Index year 2012	37,278 (8.9)	1309 (8.5)	37,224.9 (8.9)	1354.8 (8.8)
Index year 2013	40,062 (9.5)	1356 (8.8)	39,955.9 (9.5)	1462.9 (9.5)
Index year 2014	38,016 (9.0)	1291 (8.4)	37,919.1 (9.0)	1381.2 (9.0)
Index year 2015	34,319 (8.2)	1158 (7.5)	34,225.4 (8.1)	1252.1 (8.1)
Income quintiles, *n* (%)				
1 (low)	80,519 (19.1)	1414 (9.18)	79,041.4 (18.8)	2919.9 (19.0)
2	84,175 (20.0)	2568 (16.7)	83,679.2 (20.0)	2999.9 (19.5)
3	81,939 (19.5)	2783 (18.1)	81,730.3 (19.4)	2969.2 (19.3)
4	86,347 (20.5)	3806 (24.7)	86,970.8 (20.7)	3180.4 (20.7)
5 (high)	87,706 (20.9)	4836 (31.4)	89,279.7 (21.2)	3309.2 (21.5)

Abbreviations: *IPTW*, inverse probability treatment weighting; *COPD*, chronic obstructive pulmonary disease; *STI*, sexually transmitted infection

Standardized mean difference was > 0

population, a greater proportion of MFF participants fell into the highest income quintile as compared with control participants (31.4% and 20.9%, respectively). After stabilized IPTW, MFF members and controls were comparable in mean age (46.8 and 46.7 years, respectively), sex (49.6% and 50.6% males, respectively), and income quintile (21.5% and 21.2% in highest quintile, respectively). Propensity scores demonstrated significant overlap between controls and all study cohorts, satisfying the positivity assumption of propensity score methods. The mean stabilized weight in controls and in the MFF group was 0.99 (SD = 0.02) and 0.99 (SD = 0.47), respectively.

Rates of incident mental disorders, among the MFF group and controls, respectively, were as follows: mood and anxiety disorders 33% vs 28%, substance use disorders 4% vs 6%, psychotic disorders 1% vs 2%, schizophrenia 0.3% vs 0.4%, personality disorders 0.5% vs 0.8%, and dementia 3% vs 5%.

Figure 2 shows the association between MFF attendance and being diagnosed with an incident mental disorder. In stabilized IPTW models, the hazard ratios (HR) for almost all incident mental disorders were significantly lower for MFF attenders than for controls. This was observed for incident substance use disorders (HR = 0.67, 95% confidence interval (CI) 0.62–0.67), psychotic disorders (HR = 0.69, 95% CI 0.60–0.79), schizophrenia (HR = 0.69, 95% CI 0.52–0.93), personality disorders (HR = 0.63, 95% CI 0.50–0.78), and dementia (HR = 0.69, 95% CI 0.64–0.75). For mood and anxiety disorders, the hazard ratio was 1.16 (95% CI

1.12–1.19), suggesting that MFF attendance was significantly associated with a higher risk than for controls. In the sensitivity analysis that examined only hospitalizations for mood and anxiety disorders, the association was no longer significant (HR = 0.94, 95% CI 0.83–1.07).

Discussion

The main finding in this study was that attending an MFF was associated with a lower risk of incident mental health disorders than for people who did not attend. Our results contribute to a growing literature suggesting that exercise may be a protective factor against many forms of mental illness. Novel findings from this study include a significantly lower risk of incident substance use disorders and personality disorders in people attending a medical fitness facility.

While the relationship between physical exercise and mental illness has been examined in various mental disorders and in a variety of study designs, the current study offered a comprehensive assessment of a range of common and severe mental disorders, using advantages of physician diagnoses and a focus on incident disorders. One of the mechanisms that may explain this finding is the social engagement that can occur when attending a fitness facility. Previous research has demonstrated that social support and social engagement accounts for part of the observed relationship between physical activity and lower levels of depression (Harvey et al., 2010). The findings of MFF attendance and reduced risk of subsequent personality disorders and schizophrenia are particularly novel. One hypothesis might be that exercise attendance reduced the risk of a personality disorder diagnosis by serving as a healthy behaviour in place of more maladaptive behaviours. Some early experimental research has demonstrated that a session of physical exercise reduced negative emotions in participants with borderline personality disorder, but this improvement did not differ significantly from the control condition (St-Amour et al., 2022). A 2020 meta-analysis examining exercise and risk of psychosis found that self-reported exercise had no preventive benefit, although the authors noted that the literature was scarce and that self-report was unlikely to be a useful measure of exercise (Brokmeier et al., 2020).

Overall, our study findings were consistent with those of the existing literature. In particular, they are in keeping with the body of literature showing a well-established association between exercise and reduced risk of dementia (Santos-Lozano et al., 2016). A study on mood disorders found that objectively measured exercise using an accelerometer was protective against depression but the same was not true of self-reported exercise (Choi et al., 2019). In contrast with the general consensus, a meta-analysis of 35 studies including 2498 participants found no benefit to exercise as an anti-depressant; however, it is worth noting that their final analysis included only 2 of the 35 trials due to challenges with study quality (Krogh et al., 2017). A recent meta-analysis found that exercise was protective against depression and a dose–response relationship was observed (Pearce et al., 2022). Our findings showed a significant association between MFF attendance and increased incidence of mood and anxiety disorders. This was possibly due to the heterogeneous group captured in the definition of ICD-based mood and anxiety disorders, often diagnosed in primary care. Existing studies have shown mixed findings on the relationship between physical exercise and incident anxiety disorders (McDowell et al., 2019; Moreno-Peral et al., 2022), and therefore the inclusion of anxiety with mood disorders in our case definition may have contributed to this finding. There may have also been a subset of MFF

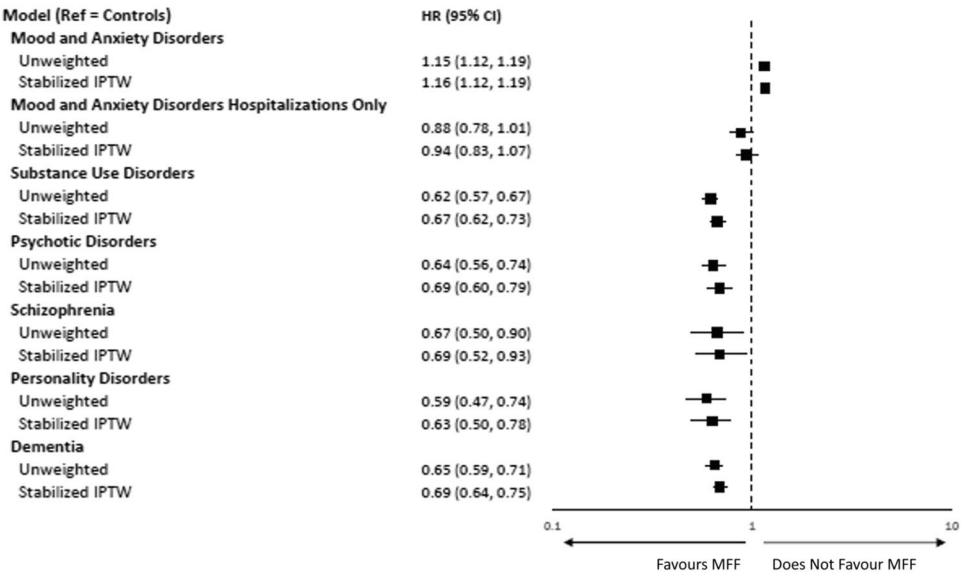

Fig. 2 Plot of hazard ratios (HR) with corresponding 95% confidence intervals (95% CI) for the associations of medical fitness facility (MFF) attendance with specific mental disorders. HR are presented for each disorder both as unweighted and then after stabilization with inverse probability of treatment weights (IPTW)

participants who had pre-existing undiagnosed mood and anxiety disorders and were incidentally diagnosed during the follow-up period; perhaps a person with latent anxiety may self-select into MFF membership due to health-related fears.

Limitations

A principal limitation in this study was the lack of direct measurement of exercise type, duration, and intensity. It was also not possible to determine which participants received non-exercise behavioural interventions as part of their membership. These metrics were not gathered, as participating fitness facilities only reported on swipe card entrance and had no systems in place to monitor what patients did during their workouts. The advantage is that facility attendance could be objectively ascertained, but at best it is a proxy measure of exercise. Assessment of exercise intensity has been addressed in other studies that have examined either self-report data or objective accelerometer-based activity (Choi et al., 2019; Pearce et al. 2022). Another limitation related to exercise is that the control group was defined by lack of membership at the MFFs. It is likely that people in the control group engaged in exercise that varied both in type and in intensity, although it should be noted that this would bias results toward the null, and that MFF participants could additionally engage in exercise outside of the MFF. A third limitation of our study was that mood and anxiety disorders were grouped together into a single category, making it difficult to apply the results directly to either individual disorder, which impeded comparability with prior work. This grouping was necessary based on the lack of ICD-9 decimal place coding in outpatient billings in the datasets, thus precluding an adequate distinction of depressive and anxiety disorders. A fourth limitation is that the study contains a large number of participants, and as a result of that statistical power, findings that may be statistically significant may actually represent a small effect. An example of this is incident mood and anxiety disorders, which were highly incident in the study population. Despite a finding that reached statistical significance, the 16% increased risk represents a small effect. A fifth limitation is that the study contained data up until 2015; a longer period of follow-up in a future investigation could offer greater insight into the longer-term effects of MFF attendance. Finally, the MCHP database relies on physician visits for diagnoses to be encoded. As a result, there may have been a subset of study participants who had pre-existing mental health conditions and who had not sought treatment and thus gone undiagnosed prior to the index date, and were later falsely encoded as new conditions. The reliance on treatment-seeking is a limitation overcome by several other studies that have used large surveys of the general population. These limitations were partially offset by the current study employing a linked data approach that ensured the objective measurement of weekly MFF attendance rather than self-reported exercise, which differs from the methodology of most other studies in this area.

Conclusion

This study found that attendance at two medical fitness facilities was associated with a decreased incidence of mental illness for most categories that were examined. These findings support MFF attendance as it may be associated with lower likelihood of the development of mental illness. Future research can aim to differentiate between the effects of various types of exercise and behavioural interventions, as well as the necessary duration and intensity to obtain benefit.

Contributions to knowledge

What does this study add to existing knowledge?

- This study provides the first examination of the effect of medical fitness facility attendance on the risk of new mental disorders. With several methodological advantages over prior research (objective measure of attendance, physician-diagnosed mental disorders, the use of administrative health databases that ensure complete cohort follow-up, inclusion of six different mental disorders), it gives further confidence to health messaging suggesting a protective health effect of exercise, and the importance of the mind-body connection.

What are the key implications for public health interventions, practice, or policy?

- A major public health implication of this study is the promotion of physical health and exercise as a protective factor against mental illness.
- It suggests that health providers should consider incorporating physical fitness recommendations as part of a healthy lifestyle; and since this study focused on a cohort with no history of mental illness, it would apply more to primary care settings.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.17269/s41997-024-00971-w.

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Author contributions Tebbi, Bolton, and Brar wrote the manuscript. Katz and Bolton conceptualized the study, oversaw the data acquisition, and led the study design. Brar led the statistical analysis. Tebbi and Bolton had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors reviewed the manuscript and approved the final version.

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Data availability Not applicable.

Code availability Not applicable.

Declarations

Ethics approval The study was approved by the Manitoba Health Information Privacy Committee (HIPC File No. 2017/2018–04).

Consent to participate Not applicable.

Consent for publication Not applicable.

Conflict of interest The authors declare no competing interests.

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