MARTIAL ARTS STUDIES

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COMPARING MENTAL HEALTH OUTCOMES OF BRAZILIAN JIU-JITSU AND CROSSFIT TRAINING AMONG TRAUMA-EXPOSED PROFESSIONALS: FINDINGS OF A MIXED-METHODS STUDY

ABSTRACT

In this paper we compare the mental health outcomes of Brazilian jiu-jitsu (BJJ) and CrossFit training among military veterans and emergency services personnel participating in 60-day programmes in either modality, using standardised questionnaires (n=60/n=40) and semi-structured interviews (n=20). We measured changes in anxiety, depression, PTSD, sleep quality, and general wellbeing between baseline, mid-point, and endpoint of the 60-day training periods, with interviews addressing participants' experiences in depth. Survey results demonstrated significant, clinically relevant improvements across all measured domains, but revealed no significant differences between modalities. Interviews suggested the value of *actively growing* through *constructive hardship* experienced within a *supportive community* – common to both modalities – may explain the survey outcomes. This study contributes further evidence of how physical activity can support mental health among communities exposed to traumatic experiences and/or ongoing stressors. It also enables critical reflection on claims regarding the unique value of martial arts in this respect.

CONTRIBUTORS

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KEYWORDS

Brazilian jiu-jitsu, CrossFit, emergency services, mental health, military veterans, wellbeing

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Comparing Mental Health Outcomes of Brazilian Jiu-Jitsu and CrossFit Training among Trauma-Exposed Professionals: Findings of a Mixed-Methods Study

Alex Channon, Julie Morgan, Jörg Huber and Laurie Higbed

INTRODUCTION

Physical activity (PA) is widely recognised within the biomedical and health sciences as offering a wide range of benefits for participants, including positive impacts on physical and mental health, as well as a host of broader wellbeing-related outcomes (e.g., Singh et al., 2023). While such observations are well-evidenced regarding the general population, evidence from a range of studies also suggests unique benefits may accrue to practitioners within various specific groups, including people with a history of trauma and/or related mental health problems, such as post-traumatic stress disorder (PTSD), anxiety, and depression (Tan et al., 2023). Indeed, these benefits have led to advocacy for PA-based interventions as a form of non-pharmacological therapy that is generally efficacious, cost-effective, and may – for some groups – appeal to users in ways that traditional therapeutic methods may not (Singh et al., 2023).

Research into the experiences of military veterans identifies barriers to accessing traditional therapies for treating PTSD and accompanying co-morbidities – problems which appear to be significantly more common in this group than the general population (Oster et al., 2017). These include structural problems relating to the costs of providing talking therapies to veterans, a desire within this population to avoid medication, or potential identity incongruence and/or social stigma around the vulnerability implied by actively seeking support (Oster et al., 2017; Randles & Finnegan, 2022). The same problems may also apply to emergency services personnel (Bell & Palmer-Conn, 2018; Jones, 2017; Walker et al., 2016). An additional concern for such professionals is that, unlike military veterans, work-related trauma is likely to be a recurrent and ongoing phenomenon. In this respect, help-seeking behaviour related to routinised experiences may be understood as implying a poor ability to continue to work in one's chosen role, presenting a further obstacle to conventional therapy for any problems experienced (Rinderer, 2022).

Alternative approaches to managing mental health difficulties take on significant value with respect to such populations, which we conceptualise here as *trauma-exposed professionals*. An emerging body of research suggests that PA may hold great promise in this regard, with one form of PA – martial arts training – garnering increasing attention in recent years.

MARTIAL ARTS AND MENTAL HEALTH

Among practitioners of various martial arts, there is a consistent and well-established belief that participation in these activities leads to a range of holistic benefits. Over several decades of research, these claims have been tested in a variety of contexts, enabling meta-analyses and systematic reviews of literature to address such propositions (e.g., Ciaccioni et al., 2024; Croom, 2014; Moore et al., 2020; Origua Rios et al., 2018). This literature points to the fact that positive psychological outcomes can be expected of martial arts training, specifically with respect to mental health, and that these may hold possible therapeutic applications. For Ciaccioni et al., martial arts and combat sports "have the potential to benefit different aspects of mental health" (2024, p. 16), while Moore et al. suggest martial arts training "improves wellbeing and reduces symptoms associated with internalising mental health issues", meaning it "may be an efficacious alternative to traditional psychological treatments" (2020, p. 410).

However, the broader findings of these reviews are complex, pointing to a more ambiguous set of outcomes overall. This is complicated by a general lack of methodological consistency across studies, as well as limited controls or comparisons, and vague conceptualisations of mechanisms to explain observed effects. Exploring the proposition of psychological impacts across *all* martial arts in a general sense may be less appropriate than focusing on narrow, more clearly defined modalities, where participant experiences will be similar and thus causal mechanisms easier to identify (or at least theorise). In this respect, research on the specific martial art of Brazilian jiu-jitsu (BJJ) offers a chance for greater clarity on such observations.

Brazilian jiu-jitsu and holistic approaches to mental health

BJJ is a grappling-based martial art that has expanded rapidly over the past four decades to become a globally popular combat sport (Blomqvist Mickelsson, 2021; Dincovici, 2012). Its techniques emphasise controlling an opponent's posture and movement, conserving energy through judicious application of force, leading to pinning positions and/or defeating opponents via submission holds (typically, chokes or joint locks). Classes tend to be taught in a format progressing from functional warm-up activity, through technique instruction and partnered practice, to free sparring (referred to in BJJ as "rolling"). Although not all BJJ practitioners compete, there are regular competitions held at multiple levels (local, national and international) in various countries and territories. With "jiu-jitsu" translating to English as "the gentle art", the emphasis of BJJ is on intense physical combat that does not involve striking or (generally, at least) slamming an opponent to the floor. Thus, it can usually be practiced at high intensities with relatively lower risk of lasting pain or serious injury than most comparable contact sports.

For the purposes of the present study, BJJ is widely believed by its practitioners to constitute a form of therapy (e.g., Farrer, 2019; see also Marich & Pirkl, 2022). The art has garnered increasing attention from scholars over such claims, with a small but growing evidence base pointing to possible therapeutic benefits (Blomqvist Mickelsson, 2021). From a theoretical point of view, Sugden (2021) employed Antonovsky's (1979) *salutogenesis* model to explain men's active construction of positive health outcomes through BJJ training. This conceptual framework stresses a holistic approach to understanding behaviours that construct pathways to states of good health, through the active pursuit of assets or resources that enable a sense of coherence in one's life (Mittelmark & Bauer, 2022). This approach is well suited for

studies of PA and mental wellbeing, where purposeful activity in pursuit of positive outcomes takes precedence over reactive treatments for curing negative ones. It is similar in this respect to Croom's (2014) discussion of positive psychology and the PERMA framework of wellbeing, as well as the holistic biopsychosocial perspective employed by Healey et al. (2025). Such perspectives on martial arts' outcomes resonate with the findings of various other recent BJJ and related martial arts studies that examine mental and social wellbeing, including identity formation (Kavanagh et al., 2019; Towns and Norman, 2025), sociability (Chinkov & Holt, 2016; Rodrigues et al., 2019), community belonging (Dincovici, 2012; Green, 2021), and emotional reflexivity (Burke, 2022; see also Maclean, 2021). Together, such research frames BJJ – and similar martial arts – as activities that can be employed in the purposeful pursuit of positive health outcomes across multiple domains (Croom, 2014; Sugden, 2021).

Most interestingly, studies have directly examined the utility of BJJ as a form of mental health intervention among military veterans (Collura, 2019; Weinberger & Burraston, 2021; Willing et al., 2019). In Weinberger and Burraston (2021) and Willing et al.'s (2019) studies, mental health constructs including PTSD, anxiety and depression were measured over time among military veterans beginning BJJ training. Both studies demonstrated positive and clinically significant results over time as their cohorts (n=32 and n=9 respectively) progressed through several months of BJJ training. Weinberger and Burraston (2021) also gathered qualitative data through open survey responses to complement psychometric measures, which compare neatly with the ethnographic report produced by Collura (2019). This data points to the role of BJJ in providing a resource to manage aggression, sublimate negative emotions, feel more powerful, bond with others and gain social acceptance, evidencing holistic benefits on multiple domains of mental health and wellbeing.

The combative practice of BJJ may also resonate with the identities of veteran participants, and thereby likely improves program adherence, positively differentiating it from conventional forms of therapy and perhaps other (less directly combat-oriented) sports and martial arts, such as non-contact tai chi or low-intensity aikido.[1] Additionally, BJJ's potential application to such ends has also been noted – though not yet measured – among law enforcement officers (Butler & Wang, 2024; Rinderer, 2022). In her analytic review essay, Rinderer (2022) argues that similar phenomena to those discussed among military veterans should theoretically apply to police officers, echoed anecdotally in Butler and Wang's (2024) survey of officers' perspectives on their experience of BJJ.

However, as with many comparable martial arts-based studies, none of the work exploring BJJ's mental health impacts features control or comparator groups, making it hard to claim whether – or theorise precisely why – the art might be responsible for these observed outcomes. The only two studies to empirically measure these phenomena to date among trauma-exposed professionals (Weinberger & Burraston, 2021; Willing et al., 2019) draw on relatively small samples, were conducted in the same cultural context (USA), and only include military personnel (including veterans) among their cohorts. As such, there is a need for further research to explore the potential of martial arts such as BJJ in fostering broad, positive mental health outcomes, specifically among trauma-exposed populations.

METHODOLOGY

To address this need, we developed the present, mixed-methods study to address the research question: *how and to what extent can BJJ function as a mental health-enhancing activity for trauma-exposed professionals?* We based our work around an intervention programme delivered by REORG, a charitable organisation supporting veterans and emergency services personnel in the United Kingdom (see REORG, 2025). Participants in this programme are funded to take part in either regular BJJ or CrossFit classes in clubs vetted by and affiliated to REORG over a 60-day period, training a minimum of two times per week for the duration.

This provided a unique opportunity to assess BJJ's outcomes against those of a comparator activity. Because CrossFit shares some similarities with BJJ (both are globally popular, physically intense, group-based exercise programmes with a partial emphasis on competition), it is a suitable activity to use for this purpose. Recent research has shown that CrossFit also holds potential for making positive mental health impacts (Cansler et al., 2023), but also that more research into this sport's outcomes is needed (Dominski et al., 2021). Given the extensive, consistently theorised and reasonably well-evidenced claims regarding BJJ's potential effectiveness in enhancing mental health, we hypothesised that *participants enrolled on the BJJ programme would experience greater improvements in these domains than those enrolled on the CrossFit programme.*

With REORG acting as a research gatekeeper, we recruited participants to the study prior to their commencement of 60-day BJJ and CrossFit intervention programmes. Participants in REORG programming select their own choice of activity and so participants were recruited to the study on this basis; that is, sampling was non-random. Surveys composed of psychometric questionnaires measuring mental health outcomes (see below) were distributed to them immediately prior to starting training (day 0 / T1) to set baseline scores against measured variables, and then again at the mid-point (day 30 / T2) and conclusion (day 60 / T3) of their programmes. In the absence of clear indicators from prior studies of a minimum time frame needed to observe changes in various mental health outcomes from these exercise modalities, this time frame was chosen for the study for the pragmatic reason that it aligned with the gatekeeper's programming timescales. A

1 These are also sometimes used in this context; see Lukoff & Strozzi-Heckler (2017) and Munro et al. (2019).

smaller subset of participants was later invited to take part in an interview about their experiences of training.

Design and measures

We designed this study with a view to building on prior research in several ways. Firstly, following Ciaccioni et al.'s (2024) call for greater consistency in measurements across martial arts studies to facilitate later reviews, we employed questionnaires aimed to measure the same phenomena described within previous quantitative and qualitative work in this field (e.g., Croom, 2014; Weinberger & Burraston, 2021; Willing et al., 2019). We used the following standardised self-report instruments commonly used in research with similar populations:

The *Generalised Anxiety Disorder Questionnaire* (GAD-7; Spitzer et al., 2006) measures severity of anxiety symptoms in the last two weeks, including seven statements about worry or somatic symptoms of anxiety. Items are responded to on a rating scale ranging from 0 (Not at all) to 3 (Nearly every day). Total scores therefore range from 0 to 21, with a higher score indicating more severe anxiety symptoms. Internal consistency within the current study was excellent at baseline (Cronbach's α = .9) and good at mid-point (α = .86) and conclusion (α = .84) of the programmes.

The *Patient Health Questionnaire* (PHQ-9; Kroenke et al., 2001) consists of nine items to evaluate severity of depressive symptoms in the last two weeks. Each item is rated on a scale from 0 (Not at all) to 3 (Nearly every day), with total scores ranging from 0 to 27 and a higher score indicating more severe depressive symptoms. Internal consistency was good at baseline (α = .86), mid-point (α = .87) and conclusion (α = .8) in the present study.

The *Posttraumatic Stress Disorder Checklist for DSM-V* (PCL-5; Weathers et al., 2013) measures the extent to which an individual has been bothered by DSM-V PTSD symptoms experienced in the last month, with reference to their most stressful life event. The checklist consists of 20 items responded to on a scale from 0 (Not at all) to 4 (extremely) with scores ranging from 0 to 80. Higher scores indicate a greater degree of PTSD symptom distress. Internal consistency was excellent at baseline (α = .93), mid-point (α = .93) and conclusion (α = .92) in the present study.

The *Pittsburgh Sleep Quality Index* (PSQI; Buysse et al., 1989) assesses sleep habits during the past month with seven components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction). This questionnaire includes 19 self-report items, with 15 of these items rated using a four-point Likert scale and four open-ended items requiring a numeric answer. These items are combined to form the seven component scores, each with a range from 0 to 3. The seven component scores are added to form a global sleep quality score ranging from 0 to 21, with higher scores indicating greater sleep disturbance. Internal consistency was acceptable at baseline (α = .73), mid-point (α = .71) and conclusion (α = .77) in the present study.

The *Warwick-Edinburgh Mental Wellbeing Scale* (WEMWBS, Tennant et al., 2007) is a 14-item measure encompassing positive aspects of mental health that focuses on the extent to which an individual has felt good and functioned well over the past two weeks. Each item is rated on a scale from 1 (None of the time) to 5 (All of the time). The total score is summed and ranges from 14 to 70, with higher scores indicating better mental wellbeing. Internal consistency of this measure in the current study was good at baseline (α = .86), and excellent at mid-point (α = .91) and conclusion (α = .91).

Secondly, as noted above, we also followed Ciaccioni et al.'s (2024, p. 16) call to incorporate an active comparator group into our study, providing the opportunity to make more coherent "conclusions about the specific effects of the structure of [martial arts] training". Since the gatekeeper organisation REORG also supported participants to take part in CrossFit as an alternative activity to BJJ, we were able to recruit and test these participants in the same manner as the BJJ cohort. In principle, observed differences (or indeed, similarities) in mental health outcomes between BJJ and CrossFit training were considered instructive in narrowing down explanations for how and why BJJ might affect participants' mental health, regarding evident similarities and differences between the exercise modalities.

Lastly, to support these explanations, we employed semi-structured interviews alongside the surveys to gather detailed accounts of participants' experiences and perspectives on their training in either modality. Interviews were conducted online using Microsoft Teams and took between 20–63 minutes, lasting on average 45 minutes. They were designed based on a consideration of the academic literature noted above and were facilitated by the first author's direct familiarity with both exercise modalities. Interviews allowed us to further explore the differences and similarities between the modalities and thus better explain potential mechanisms of change observed via the surveys.

Participants and recruitment

In total, 167 eligible participants were invited by REORG to take part in the quantitative arm of the study, and 119 agreed to participate. However, only 60 participants returned completed survey responses across all three time points of their training programmes for the PCL-5, GAD-7, PHQ-9 and WEMWBS, with only 40 of these participants returning complete data on the PSQI.[2] As such, this paper reports on the data provided by these 60 (and 40) participants (see Tables 1 and 2, respectively). The mean age of these participants was 38.8 years (*SD* = 9.92).

2 We note that participation tracking undertaken by REORG suggests that all but two of the 119 survey participants completed their 60-day BJJ/CrossFit activity programmes. A survey completion rate of approximately 50% (with 33% on the PSQI) might be considered reasonably successful in light of general trends in survey research.

Table 1. Participant characteristics for 60-participant quantitative sample (GAD-7, PHQ-9, PCL-5, WEMWBS)

	BJJ (n = 21) n (%)	CrossFit (n = 39) n (%)
Gender		
Female	1 (4.8)	12 (30.8)
Male	20 (95.2)	27 (69.2)
Professional background		
Military Veteran	10 (47.6)	11 (28.2)
Emergency Services	7 (33.3)	21 (53.8)
Military Veteran & Emergency Services	4 (19)	7 (17.9)

Table 2. Participant characteristics for 40-participant quantitative sample (PSQI)

	BJJ (n = 11) n (%)	CrossFit (n = 29) n (%)
Gender		
Female	1 (9.1)	10 (34.5)
Male	10 (90.9)	19 (65.5)
Professional background		
Military Veteran	4 (36.4)	10 (34.5)
Emergency Services	5 (45.5)	16 (55.2)
Military Veteran & Emergency Services	2 (18.2)	3 (10.3)

Table 3. Participant characteristics for qualitative, semi-strcutured interview sample

	BJJ (n = 14) n (%)	CrossFit (n = 6) n (%)
Gender		
Female	1 (7.1)	2 (33.3)
Male	13 (92.9)	4 (66.7)
Professional background		
Military Veteran	3 (21.4)	4 (66.7)
Emergency Services	5 (35.7)	2 (33.3)
Military Veteran & Emergency Services	6 (42.9)	0 (0.00)

Because participants were recruited to their exercise programme on a rolling, ad-hoc basis rather than as a single cohort, the study similarly recruited them over an extended period, lasting between June 2024 and March 2025. For the qualitative arm of the study, 20 participants agreed to an interview upon completion of their 60-day survey. Invites were sent to all participants who had completed all three surveys, continuing until a point of data saturation which was felt to have been reached at 20 interviews. The mean age of interviewees was 41.5 years (*SD* = 9.60). Interviews took place between September and December 2024. These included 14 interviewees who had participated in BJJ and 6 who had participated in CrossFit (see Table 3).

Ethics and registration

The study was granted ethical clearance by the University of Brighton's cross-school research ethics committee (CREC-C, ref. no. 14037 & 14066). Ethical clearance was dependent on anonymity for participants, the provision of detailed briefing materials and receipt of participants' informed consent, as well as secure data handling and storage in line with GDPR regulations. In addition, ethical procedures involved consulting with another charity, Via, that assists REORG with clinical psychology expertise, which REORG requested as a condition of supporting this study. A Via psychologist joined the research team to oversee an ethical protocol for responding to survey participants whose PCL-5 scores were suggestive of a potential PTSD diagnosis (i.e., scores of 31 or above), and those who indicated any positive responses to question 9 on the PHQ-9, which concerns suicide ideation. Survey responses were monitored by the research team

twice weekly throughout the course of the study, and an intervention email including bespoke support information for either veterans or emergency services personnel was immediately sent to any participant returning such scores.

Given the nature of the populations and phenomena being studied we decided against a control group. A true control over participants' access to therapeutic treatments from within this potentially vulnerable population could not be considered ethically sound. A control group would mean requesting that individuals likely to be at risk of trauma-related mental health problems avoid activities that could alleviate those problems, for the duration of a study that they would not stand to directly benefit from as individuals. After consultation with REORG as the gatekeeper and Via as a clinical psychological support organisation, it was felt that the ethos of self-sacrifice and duty shared by many veterans and emergency services personnel would mean that requesting they avoid (even only PA-related) interventions for 60 days could likely result in perpetuating a common tendency to avoid help-seeking in line with a stoic sense of moral responsibility, and/or not wanting to be a burden to others (see Randles & Finnegan, 2022). This was not something that the research team felt appropriate and so decided not to include this in the research design. It was made clear at the point of ethical review that this was a conscious choice, which the ethics reviewers agreed was responsible and fitting.

In this way, although less desirable from the point of view of methodological rigor, the use of an active comparator group instead of a control was seen as a more ethically sound way to address the research question among this specific population. Once ethical approval was granted, the research project was registered on the OSF pre-registration database. The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

Data analysis

Quantitative data were analysed by the second and third authors, using SPSS version 29. Participants who did not complete all three surveys were excluded from the analysis. Mixed design ANOVAs (2 exercise groups x 3 time points) were used to test for main and interaction effects between the BJJ and CrossFit groups on the outcome measures (GAD-7, PHQ-9, PCL-5, PSQI, WEMWBS) across the 3 time points: baseline at day 0 (T1), mid-point at day 30 (T2), and end of programme at day 60 (T3). The assumption of sphericity was not met for measures of anxiety, depressive symptoms, PTSD symptoms and wellbeing, therefore Greenhouse-Geisser corrections were used for these measures. Post-hoc tests with Bonferroni's correction for multiple comparisons were applied to analyse differences between T1, T2 and T3 outcome measures.

Qualitative data were transcribed using Microsoft Teams auto transcription, with errors subsequently corrected by the first author. Transcripts were then inductively analysed by the first author using an approach derived from thematic analysis. This began with initial coding, generating over 260 initial codes, which were reduced into 14 discreet thematic clusters identifying patterns in participants' accounts. These clustered codes were then written up into analytical narratives describing different aspects of the participants' experiences, which were then themselves re-coded for higher-order conceptual themes and sub-themes. Seven main and seven sub-themes were thus defined, summarised in short statements to reveal the major findings of the interviews.

QUANTITATIVE RESULTS

There were no significant differences between the two interventions on baseline scores for GAD-7, PHQ-9, PCL-5, and WEMWBS. However, for baseline PSQI scores, participants in the BJJ group reported greater sleep disturbances than those in the CrossFit programme (see Table 4).

Anxiety (GAD-7)

Figure 1 shows the change in anxiety symptoms over the course of the BJJ and CrossFit intervention programmes. There was a significant main effect of time on GAD-7 scores, $F(1.74, 100.95) = 39.92$, $p < .001$, $\eta_p^2 = .408$, indicating that across both intervention programmes, anxiety symptoms significantly decreased from T1 to T2, $p < .001$, 95% *CI* [1.82, 4.69], from T1 to T3, $p < .001$, 95% *CI* [3.10, 5.73], and from T2 to T3, $p < .018$, 95% *CI* [0.15, 2.16]. However, contrary to our predictions, decrease in anxiety was not greater in the BJJ group than the CrossFit group. There was no significant interaction between intervention programme x time, $F(1.74, 100.95) = 2.35$, $p = .108$, $\eta_p^2 = .039$, and no significant main effect of intervention programme, $F(1, 58) = 0.54$, $p = .467$, $\eta_p^2 = .009$.

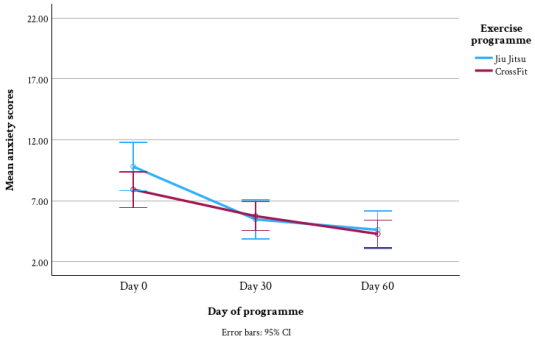

Figure 1. Change in anxiety symptoms (based on scores from the GAD-7)

Table 4. Means for outcome measures across the BJJ and CrossFit programmes

	Baseline (T1)		Day 30 (T2)		Day 60 (T3)		
Outcome Measures	*M*	*SD*	*M*	*SD*	*M*	*SD*	*n*
GAD-7							
BJJ	9.81	5.06	5.48	3.37	4.62	3.50	21
CrossFit	7.92	4.28	5.74	3.80	4.28	3.58	39
Total	8.58	4.61	5.65	3.63	4.40	3.53	60
PHQ-9							
BJJ	10.76	5.52	5.19	3.97	4.52	3.93	21
CrossFit	9.38	5.04	6.23	4.75	4.62	3.53	39
Total	9.78	5.21	5.87	4.49	4.58	3.64	60
PCL-5							
BJJ	32.86	12.48	17.24	9.64	14.14	11.21	21
CrossFit	26.87	13.62	17.18	11.39	14.46	10.45	39
Total	28.97	13.43	17.20	10.72	14.53	10.63	60
PSQI							
BJJ	11.91_a	3.75	9.18	5.12	6.73	3.82	11
CrossFit	9.34_a	2.99	7.79	2.76	6.52	2.91	29
Total	10.05	3.37	8.18	3.54	6.58	3.14	40
WEMWBS							
BJJ	39.67	6.59	49.14	7.22	51.52	9.07	21
CrossFit	39.26	5.86	46.69	5.89	50.67	6.60	39
Total	39.40	6.07	47.55	6.43	50.97	7.49	60

Abbreviations: GAD-7 = Generalized Anxiety Disorder Questionnaire; PHQ-9 = Patient Health Questionnaire; PCL-5 = PTSD Checklist for DSM-5; PSQI = Pittsburgh Sleep Quality Index; WEMWBS = Warwick-Edinburgh Mental Wellbeing Scale

[a] Means sharing a subscript are significantly different at baseline, $p < .05$

Depressive symptoms (PHQ-9)

There was a significant main effect of time on PHQ-9 scores, $F(1.72, 99.87) = 42.16$, $p < .001$, $\eta_p^2 = .421$. As shown in Figure 2, depressive symptoms significantly decreased from T1 to T2, $p < .001$, 95% *CI* [2.72, 6.00], and from T1 to T3, $p < .001$, 95% *CI* [3.74, 7.27], but no further significant decrease was shown from T2 to T3, $p = .074$, 95% *CI* [-0.08, 2.36]. Decreases in depressive symptoms were not greater in the BJJ group, with the results indicating no significant intervention programme x time interaction, $F(1.72, 99.87) = 1.85$, $p = .167$, $\eta_p^2 = .031$, and no significant main effect of the intervention group, $F(1, 58) = 0.01$, $p = .933$, $\eta_p^2 = .000$.

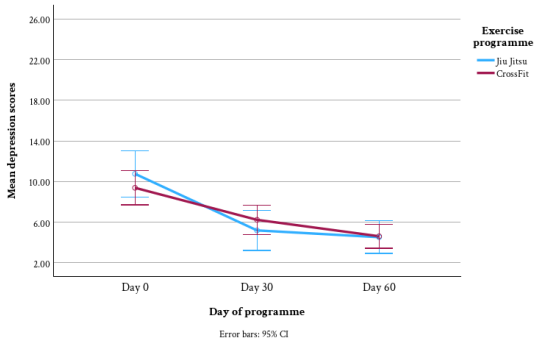

Figure 2. Change in depression symptoms (based on scores from the PHQ-9)

PTSD symptoms (PCL-5)

PCL-5 scores decreased across both the BJJ and CrossFit intervention programmes, see Figure 3, $F(1.66, 96.11) = 51.95$, $p < .001$, $\eta_p^2 = .472$, with significant decreases from T1 to T2, $p < .001$, 95% *CI* [8.45, 16.86], and from T1 to T3, $p < .001$, 95% *CI* [10.95, 20.18], but no further significant decrease from T2 to T3, $p = .061$, 95% *CI* [-0.10, 5.91]. There was no significant interaction between intervention programme and time, $F(1.66, 96.11) = 2.37$, $p = .108$, $\eta_p^2 = .039$, and no significant main effect of intervention group, $F(1, 58) = 0.57$, $p = .455$, $\eta_p^2 = .01$.

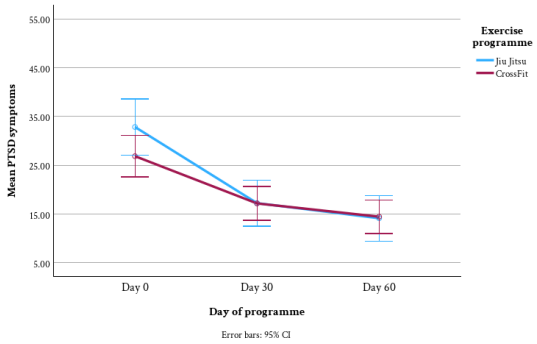

Figure 3. Change in PTSD symptoms (based on scores from the PCL-5)

Sleep quality (PSQI)

Figure 4 shows the significant decrease in sleep disturbance reported across both intervention programmes, $F[2, 76] = 24.76$, $p < .001$, $\eta_p^2 = .395$. PSQI scores significantly decreased from T1 to T2, $p = .001$, 95% *CI* [0.75, 3.53], from T1 to T3, $p < .001$, 95% *CI* [2.36, 5.65], and from T2 to T3, $p = .001$, 95% *CI* [0.66, 3.07]. However, this improvement in sleep quality was not greater in the BJJ group, with no significant intervention x time interaction, $F(2, 76) = 2.14$, $p = .125$, $\eta_p^2 = .053$, and no significant main effect of intervention group, $F(1, 38) = 2.05$, $p = .161$, $\eta_p^2 = .05$.

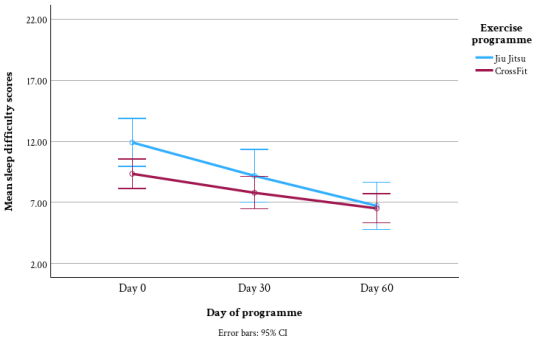

Figure 4. Change in sleep difficulty (based on scores from the PSQI)

Wellbeing (WEMWBS)

There was a significant main effect of time on wellbeing ($F[1.71, 99.18] = 98.50$, $p < .001$, $\eta_p^2 = .629$). As shown in Figure 5, WEMWBS scores significantly increased from T1 to T2, $p < .001$, 95% *CI* [-10.44, -6.47], and from T1 to T3, $p < .001$, 95% *CI* [-14.13, -9.13], with a further significant increase from T2 to T3, $p < .001$, 95% *CI* [-4.97, -1.39]. Similar to the other outcome measures, there was no significant intervention x time interaction, $F[1.71, 99.18] = 0.78$, $p = .442$, $\eta_p^2 = .013$, and no significant main effect of the intervention programme, $F[1, 58] = 0.66$, $p = .419$, $\eta_p^2 = .011$.

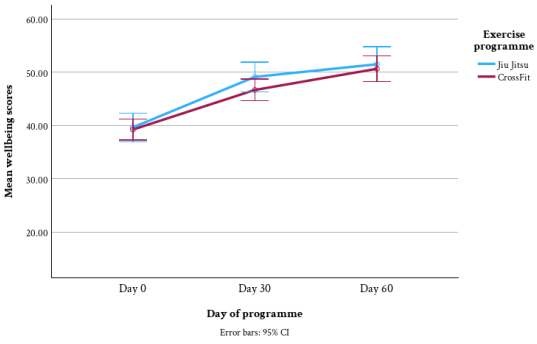

Figure 5. Change in wellbeing (based on scores from the WEMWBS)

Table 5. Percentage of participants who met MCID at Day 60 (T3) for mental health outcomes

	BJJ)		CrossFit	
	MCID met % (n)	*MCID not met % (n)*	*MCID met % (n)*	*MCID not met % (n)*
Anxiety (n = 60)	66.7 (14)	33.3 (7)	46.2 (18)	53.8 (21)
Depression (n = 60)	76.2 (16)	23.8 (5)	56.4 (22)	43.6 (17)
PTSD (n = 60)	76.2 (16)	23.8 (5)	66.7 (26)	33.3 (13)
Sleep (n = 60)	63.6 (7)	36.4 (4)	51.7 (15)	48.3 (14)
Wellbeing (n = 60)	90.5 (19)	9.5 (2)	87.2 (34)	12.8 (5)

Minimal clinically important differences (MCID)[3]

The minimal clinically important difference (MCID) for each of the outcome measures were taken as 3.3 for the GAD-7 and 3.7 for the PHQ-9 (Bauer-Staeb et al., 2021), 10 for the PCL-5 (Blanchard et al., 2023), 3 for the PSQI (Qin et al., 2024) and 2.8 for the WEMWBS (Dunn et al., 2023). Table 5 highlights the percentage of participants in the BJJ and CrossFit groups who met MCID on each of the outcome measures based on change scores from baseline to Day 60 (T3) of the interventions. Fisher's exact tests indicated there were no significant associations between the BJJ and CrossFit groups in number of participants who met or did not meet MCID (see Table 5), therefore the type of programme did not appear to affect whether MCID was reached. The percentage of participants across both programmes who met MCID showed that 53.3% (n = 32) were classified as having had a clinically meaningful improvement in anxiety, 63.3% (n = 38) showed clinical improvements in depressive symptoms, 70% (42) improved in PTSD symptoms, 55% (n = 22) improved sleep quality, and 88.3% (n = 53) improved in wellbeing.

QUALITATIVE FINDINGS

The thematic analysis of interviews resulted in seven main themes and seven sub-themes. They are presented in alphabetical order by main theme, illustrated with excerpts from interview data. Each quoted participant has their sex, age, PA modality, and professional background (Veteran, EmServ) noted.

Active edification (with sub-themes *empowerment*, *growth* and *pride*)

Interviewees reported that participating in either BJJ or CrossFit enabled them to actively improve their lives in several domains, principally with respect to mental health and wellbeing, physical health and lifestyle, and opportunities for positive identity construction and self-development. Emphasis here was given to the fact that physical activity programmes highlight participants' agency in developing, recovering, and growing, helping to shed a sense of helplessness, and/or the passivity that was perhaps implied by (some) other forms of mental health support. In this sense, some participants reported feeling *empowered* to take more positive action in their lives because of training in BJJ or CrossFit. For instance, one participant told how, before starting CrossFit, she "had no motivation at all to do anything ... [and] was a heavy drinker", but now trains three times a week and has "a much better relationship with alcohol" (P9, F, 31, CrossFit, Veteran) thanks to the motivating effect of her training.

By challenging themselves to develop new physical, mental and social skills, participants were able to experience a fulfilling sense of *growth*. This was sometimes identified as springing from the "growth mindset" (P10, M, 34, CrossFit, EmServ) or "atmosphere that's very much about growth" (P2, M, 35, BJJ, EmServ) evident at the clubs they trained within. All participants reported significant improvements in physical health, both with respect to losing weight and/or gaining fitness, but for some also developing healthier exercise patterns, defined around increasing ability rather than weight loss or body image: "[instead of] obsessing

3 MCIDs represent the smallest degree of change which a patient may experience as meaningful. We accept that the cited MCID benchmark values may lack practical validity for these specific populations, while the meaningfulness of changes in reality – and thus their implications for clinical work – require patient and clinician assessment on an individual, ongoing and contextual basis. For group-level analytical purposes, MCIDs allow us to view reported changes through an additional conceptual lens, providing a direct comparison of the programmes' impact on different variables relative to the proportion of individuals reporting a change above (admittedly imprecise) benchmark MCID values. This is only intended to add further analytical detail and not as a guide to clinical practices.

about, you know, a number on a scale ... now it's more about feeling strong and feeling good, healthy, energised" (P7, F, 25, BJJ, EmServ). Consequently, participants took *pride* in celebrating their achievements within training and thought more positively of themselves and their abilities:

> I was quite proud of myself ... I think it's really helped, like improve my own self-esteem and image that I have of myself, because I've proven to myself again and again that I am capable of doing difficult things. (P4: M, 35, BJJ, Veteran)

Constructive hardship (with sub-themes *shared suffering* and *BJJ uniqueness*)

The difficulty of BJJ and CrossFit reportedly pushed participants mentally and physically like few other activities could. The challenges they represent provided fun, psychologically valuable experiences which facilitated the *active edification* noted above. This difficulty was therefore central to their meaning for participants: "[BJJ] is so difficult ... it's mentally exhausting ... but that's why I say it with pride, you know, that's why I tell people I do it because like, I'm mentally strong!" (P7, F, 25, BJJ, EmServ). The difficulty of training in either modality was suggested to force participants to focus on the present, providing a kind of mental holiday from daily stress: "It did me a world of good to get out and move my body more and not have to think about the problems that I've had to face along the day. It just, it drowns them all out" (P3, F, 35, CrossFit, EmServ).

In this sense, many participants spoke of the intense focus required from the technical demands of CrossFit exercises and BJJ rolling, describing them as having a meditative effect, forcing them into the present moment and blocking out intrusive thoughts: "You'll be amazed when you're being chucked about by a hairy, sweaty man, just how unimportant everything else becomes ... every single stress or concern or red flag in my brain dissolved for that hour" (P5: M, 42, BJJ, EmServ). One participant used the term "*shared suffering*" (P8: M, 42, BJJ, Veteran and EmServ) to describe their training as "something kind of unifying ... which you definitely kind of go through in the military". When exercising in pairs or groups, jointly engaging in enjoyable, intense and deeply meaningful challenges was described by many participants as a powerful bonding experience across both modalities, supporting the development of *social bonding* noted below.

Although most of the data gathered in this study point towards similarities in experiences and outcomes, some responses suggest a certain *Uniqueness of BJJ*; namely, the combative elements of the martial art can distinguish it from other activities, including CrossFit, providing additional avenues for *active edification*. This was most often exemplified through recourse to (some) participants' enjoyment of martial arts or appreciation of the values associated with non-violent combat (see Channon, 2020). Most interestingly with respect to mental health outcomes, some BJJ participants discussed how they had developed greater resilience and could remain calmer under pressure from the experience of rolling: "Jiu-jitsu, it helps people with that, to stay calm ... you can keep that composure and maintain that calmness" (P12: M, 34, BJJ, Veteran and EmServ).

Disruptions

All participants reported a range of negative experiences, illnesses, injuries, and other problems that had detrimentally impacted their lives in the past or continued to trouble them in the present, with all participants disclosing prior experience of at least one form of mental health problem. Several participants also recognised that "people in the emergency services and military ... are all quite good at masking how they're actually feeling and just going out, getting on with the job" (P10: M, 34, CrossFit, EmServ), explaining this reticence to seek help or admit a need for it as a key problem in exacerbating their own struggles.

Although these discussions were largely contextualised as explaining why participants took up BJJ or CrossFit to begin with, they also identified potential future threats to their health and wellbeing which they attempted to manage while training. Interestingly, some participants deliberately moderated their engagement in PA with respect to avoiding pitfalls such as developing "an obsession" with exercise (P17: M, 53, BJJ, Veteran and EmServ), or as a response to "picking up injuries constantly" (P18: M, 57, BJJ, Veteran and EmServ) as an older participant taking up an unfamiliar sport. In this sense, using PA in moderation was advocated by many in our sample as a sensible, healthy way to achieve positive outcomes.

Heterogeneity

Veterans and emergency services personnel are diverse groups, while BJJ and CrossFit gyms can differ widely in their social makeup, culture, and pedagogical emphasis. For instance, some participants reported enjoying elements of military-style approaches to BJJ training, but others reported enjoying more laid-back approaches in either BJJ or CrossFit. Equally, some participants spoke critically about "horrendous" and "misogynistic" (P7: F, 25, BJJ, EmServ) social environments in gyms they had previously tried to train at, contrasting them with their current, more inclusive and welcoming clubs.[4] Ensuring that gyms were cognisant of and respectful towards diversity and made clear efforts to be inclusive of all comers were thus voiced as key concerns by several participants. Tellingly, all in the sample believed the gyms they currently trained at were doing well in this

4 A growing concern in research on BJJ is a trend seen in many other male-dominated sports regarding sexual harassment. Although it is evidently not a uniform problem in BJJ, and discussing or analysing its exact prevalence is beyond the scope of the current article, it appears widespread enough to warrant closer attention from researchers and leaders of the sport (see Brito et al., 2025; Eggleton and Skea, 2024; Seethaler et al., 2025). Academic research on CrossFit does not currently suggest the same.

respect, suggesting that the vetting of clubs by REORG had helped ensure participants' acceptance and positive experiences.

With individual variation in mind, adaptable approaches to supporting various people/groups were advised. Several participants gave credit to their current coaches for accommodating their specific physical needs: "The staff at the gym ... they've gone out of their way to make sure there's things I can do that aren't hurting ... so that I'm fully participating" (P1: M, 55, CrossFit, Veteran). Meanwhile, others applauded coaches for recognising and validating their identities:

> The coach ... although he's not forces, he's very pro-forces and he calls me 'Royal',[5] right? Yeah, it's a sign, he understands where we come from, which is really nice. (P11: M, 54, BJJ, Veteran)

Loss/recovery

Several participants reported having lost social connections, identities, opportunities, and other important resources for living healthy, happy lives, either as a result of career transitions out of the military, or other important life changes. Through participating in BJJ or CrossFit they were able to recover some of these things or replace them with positive alternatives. This largely centred on rebuilding social connections, as described below, whereby veterans (in particular) often reported reliving the most positive aspects of military life through a restoration of the camaraderie they were missing after leaving the armed forces (see Collura, 2019). But this also involved recovering a sense of purpose, identity, and values that were missing from their lives. This was more commonly reported by the veteran participants; for these, it was important that training "mirrors forces life" (P11: M, 54, BJJ, Veteran) in a way they mostly found "fantastic ... [because] you got a common struggle, a common goal again. You're even back in uniform!"[6] (P18: M, 57, BJJ, Veteran and EmServ). One veteran neatly remarked:

> Why have I not done this sooner? It's what I've been missing, isn't it. It's a bit of me ... A common phrase in the army is, 'civvies pay thousands for this' ... well, I won't pay thousands for [CrossFit], but you know, somewhere, I probably would. (P16, M, 31, CrossFit, Veteran)

Professional congruence

As indicated above, there are important similarities between BJJ and CrossFit training and the activities, community, and values present in the military and some emergency services roles. As well as resonating with professional and personal identities, either PA modality could also benefit or align with current or past work duties. This was considered valuable for emergency services personnel in particular, whose busy work schedules meant finding time to train sometimes needed added justification. One participant noted: "I have interest from my work perspective about my performance under pressure. High fidelity simulation is something we do to try and push each other ... jiu-jitsu is helping with that I think" (P15: M, 39, BJJ, Veteran and EmServ). Another explained:

> The other day I was up there, I had to get out of the car and sprint down an alleyway, jump a few walls, and then have a fight with someone ... [In CrossFit], we are carrying kit, jumping over walls, jumping up things and running ... it echoes normal police work. (P10: M, 34, CrossFit, EmServ)

Social bonding (with sub-themes *caring communities* and *enhanced relationships*)

Most participants discussed the social bonding they experienced within their gyms as the primary factor driving positive change through training. While many participants marvelled at (and enjoyed) the diversity of the groups they trained with, several pointed to the importance of meeting likeminded training partners from across this wide social spectrum: "We're all just people training together, no matter what background ... and you're doing it in a safe environment with people that know exactly what you're doing and why you're doing it, and they're doing the exact same thing" (P5: M, 42, BJJ, EmServ). As well as their immediate clubmates, being part of BJJ or CrossFit – both globally popular, widely practiced activities with well-established competitive networks and online communities – provided participants with wider networks for connection. For military veterans, this also meant being able to reconnect with old comrades who trained in the same modalities elsewhere, and/or socialise with other veterans in their gyms. These were reported as major factors in improving the mental health and wellbeing of participants, particularly those who otherwise felt isolated, abandoned, or disconnected from others:

> I'm naturally quite an open and gregarious person but I'd found myself shutting down and becoming more and more isolated ... It's great to have [CrossFit] and for it to be like, a group experience ... CrossFit gives me hope that I can be a normal person again. (P19: M, 59, CrossFit, Veteran)

When discussing the nature of the social bonds they were building, all of the participants stressed how their gyms were comprised of welcoming, supportive, *caring communities*. Much of this turned on the shared orientation towards promoting mental health, which has become an element of both BJJ and CrossFit's

5 Short for "Royal Marines", the branch of the military this participant served in and a common moniker for marines among British military communities.

6 This participant refers to wearing the *gi* or *kimono* – a traditional, heavy cotton training uniform – in BJJ. Some BJJ clubs require their members to wear branded gis and/or rashguards, while others do not; however, in a gi class, all participants would normally wear a gi of some sort. Many CrossFit gyms also produce their own branded sportswear, helping to foster collective identity in a similar way. The importance of material culture in building group identity is beginning to be explored in these contexts (see de Benedittis & Camoletto, 2022; Towns & Norman, 2025).

wider public discourse.[7] Evidently this trend translated well into practice in the experiences of this study's sample: "We all talk before the class starts and then we go on with the training, and then afterwards everyone's like, supporting each other as such, so yeah that is miles better [than individual sports]" (P17: M, 53, BJJ, Veteran and EmServ); "There's a few of us that go and have a coffee club like after the classes ... You do see some traumatic stuff, so, it's good to make the most of the CrossFit scene, not just the physical side" (P10: M, 34, CrossFit, EmServ). Perhaps most importantly here, developing trust among their training partners was often highlighted as a core component of belonging to the community: "You're putting yourself in positions of discomfort, of vulnerability ... so there's that massive trust, which is something I like ... [these are] 100% very safe communities" (P13: M, 50, BJJ, EmServ).

DISCUSSION

The findings of this mixed-methods study add valuable depth to the current knowledge base on the applicability of PA as a vehicle for enhancing mental health among trauma-exposed professionals. Although the focus of the research question was on BJJ (and by implication, related martial arts practices), the inclusion of a (non-martial) comparator activity in the research design has enabled us to question the extent to which BJJ (etc.) offers *unique* possibilities for improving mental health. The quantitative data, capturing changes within a narrow but important range of mental health characteristics via standardised questionnaires, showed strong positive outcomes for *both* BJJ *and* CrossFit in the measured domains, with no statistically significant differences between the two. The qualitative data, exploring participants' perspectives in a more rounded and comprehensive manner, also revealed many core similarities in reported outcomes and likely mechanisms, with only a few distinctive elements related to BJJ and its likely impact on resilience, which was not explicitly tied to the mental health variables we measured.

Our quantitative data point to some interesting variability in the impact of training on different mental health constructs over time. That is, PTSD and depression symptoms improved between baseline and mid-point (day 30) measures, but did not improve further (between mid- and endpoint/day 60 measures). Meanwhile, anxiety, sleep quality, and wellbeing all improved continually across each time point. There is little indication from prior literature, or from our qualitative data, as to why this might be the case, suggesting a need for further research to better clarify and/or explain this finding.

Otherwise, our study makes an important contribution to the literature in that we are able to posit, with greater confidence, possible explanations for the utility of BJJ as a mental health intervention than has previously been the case (in quantitative studies with no comparators, and qualitative studies with no standardised measures). That is, the *shared characteristics* of BJJ and CrossFit are most likely responsible for the positive impacts these activities can make to participants' mental health. Both modalities feature physically intense, technically challenging and ultimately very difficult exercise which forces practitioners to be present-centred; they are performed in ways that emphasise personal development and growth across multiple domains; they take place in social environments requiring (and developing) strong bonds of cooperation and trust between partners; and they are both globally popular activities with well-established communities of practice, recognisable brands and varied social meanings.

These characteristics align well with the theoretical notions outlined in previous literature and discussed above, vis-a-vis holistic and positive notions of mental health. Here then, both BJJ and CrossFit appear to offer participants numerous opportunities to acquire resources for health improvement, principally through improved physical fitness, psychological transformation and social connection, in contexts rich with personally (and professionally) meaningful experiences (see Sugden, 2021). Thus, we suggest that BJJ and CrossFit are both good examples of activities which may be used for initiatives such as *social prescribing* (see Drinkwater et al., 2019), providing a relatively low-cost and accessible alternative to conventional therapies for trauma-exposed professionals – particularly given that they may resonate neatly with the identities of these groups, possibly improving adherence.

However, recognising the diversity of our sampling, and the range of actual experiences taking place in BJJ/CrossFit training environments, is important to give some nuance to this discussion.[8] As quickly became evident during interviews, 'trauma-exposed professionals' may share some types of experiences, but their wider life histories, personalities, tastes and dispositions, etc., vary widely. Some interviewees recognised this explicitly, and many highlighted that such diversity meant therapeutic PA interventions would rarely work on a "one size fits all" basis. We note this corresponds well with the variability of the data in Table 5, regarding the proportion of individuals in our sample reporting changes that met MCID thresholds against the measured mental health variables.

The value of coaches recognising individual needs was also highlighted several times in interviews. This typically involved physical differences, mostly pertaining to disabilities or aging, but also psychological aspects relating to degrees of trauma and/or

7 A brief search online will turn up a plethora of images, blog posts, event fliers, and social media pages advocating BJJ and/or CrossFit for mental health, indicative of a widespread acknowledgement and aspiration towards the kinds of outcomes reported on in this paper.

8 See Sandford et al. (2021) for a recent example of a critical approach to describing martial arts interventions on the basis of simple classifications or single disciplines (e.g., modern martial arts; BJJ). As noted in the limitations section, we were unable to employ the precision these authors advocate for in our analysis, although we recognise the value of doing so in future research.

mental illnesses, as well as demographic factors such as gender (especially so for women in BJJ, a typically male-dominated sport). Thus, while the present study evidences positive outcomes in BJJ and CrossFit, it also supports the need for context-sensitive application of this knowledge and the recognition that these activities sometimes need adaptation and/or careful implementation to succeed in supporting the mental health and wellbeing of diverse populations.

CONCLUSION

This study is the first to have attempted to measure mental health outcomes among trauma-exposed professionals within BJJ alongside the use of a comparator activity (CrossFit). It is the first study using a UK sample to measure the impact of any martial art programme on the mental health of such groups, including military veterans. Given the lack of significant differences in outcomes, and the emphasis placed in interviews on shared characteristics of these PA modalities, our study provides further support to the notion that this population may be well-served by such types of PA as a form of mental health-enhancing activity. Indeed, our study paints an optimistic picture of the potential of these approaches to make meaningful differences in enhancing health across multiple domains, particularly when undertaken in a moderate capacity and with a view to inclusive practice. Given the very similar outcomes between modalities observed and recorded in this study, we would argue that there is a case to consider *physically challenging*, *group-based* and *growth-oriented* physical activities for social prescribing (or related non-pharmacological treatment initiatives) for individuals with a range of trauma-related mental health conditions.

Limitations and further research

The present study is limited in several respects. Firstly, low rates of survey completion across the 60-day training programmes utilised for data collection left us with a small sample size, particularly among the BJJ cohort, which reduces the generalisability of the findings and necessitates further, follow-up research to build on the results evidenced here. This low completion rate particularly affected the gender distribution across the two modalities, leaving us unable to confidently explore gender differences in the sample. Secondly, a lack of proper controls, albeit in line with ethical concerns, similarly erodes the certainty of our conclusions regarding cause and effect. Another significant limitation was the reliance on participants training at different sites, reducing the precision with which we can describe the exact nature of the interventions they participated in. Further, our recruitment of a diverse sample of veterans (from different branches of the military, without controls over combat experience or time since departing service) and emergency services workers (including fire brigade, paramedics, police, and more) muddies the analytical waters regarding the nature of past and ongoing exposure to trauma.

In future, follow-up studies would do well to recruit larger, more clearly differentiated samples and ensure a better gender distribution across modalities. They should utilise meaningful controls insomuch as it is ethically possible to do so, and attempt to better control (and describe; see Sandford et al., 2021) the content of any BJJ, CrossFit, or other PA programme used. They may also measure other psychological variables, such as resilience, which interviews indicated may be more pronounced as an outcome among the BJJ cohort than those in the CrossFit group. Meanwhile, qualitative studies may incorporate longitudinal methods in place of the cross-sectional interview sampling used here; this might involve further ethnographic study (e.g., Collura, 2019) and/or interviewing at multiple points in longer-term participation in BJJ, CrossFit, or other modalities. Longer time frames may be necessary to observe longer-term changes in mental health that may arise from extended practice of, adaptation to, and perhaps deeper socialisation within either modality.

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Declaration of competing interests

Alex Channon is the editor-in-chief of *Martial Arts Studies*. He took no part in the editorial processes for this article.

Declaration of artificial intelligence use

Microsoft Teams' AI-powered transcription function was used to automatically transcribe interviews. The outputs generated by AI were cross-checked with audio files. All mistakes were manually amended before the transcripts were analysed.

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