Case Study Template

Promoting Immersive Engagement with Core Readings

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Abstract

This case study outlines the development and trial of ***immersive readings*** or the "**iREAD"**: a time-efficient and theory-informed tool to enhance student engagement with core readings. Using standard functions in Adobe Pro, I interspersed a series of **pedagogically informed comments** to guide the student through one core reading per week for 4 weeks. Comments are *questions or statements* designed to direct attention or prompt reflection on four key pillars: **knowledge**, **critique**, **application**, and **writing style**. The resulting iREAD revolutionises weekly readings from a passive task students *must do*, to an immersive learning experience they *want to do*.

1. Background

Across 15 years higher education teaching experience, I had grown frustrated with the small number of students completing the weekly recommended core readings. Seemingly only the very conscientious consistently engaged and even then, it was described as a chore and there was uncertainty as to what to take from each chapter or article. This year, I turned to the literature to discover this was not a unique problem. Sector-wide, students find reading a passive, unfulfilling, and demotivating experience; the result is they stop doing it.

In contrast, the literature also suggests that regular academic reading leads to improved performance across a range of markers, including increased knowledge and comprehension, improved writing style, and enhanced critical analysis. In summary, core reading is invaluable, but few students are motivated to do it or enjoy it when they do. Against this backdrop, I was driven to find a way to make my weekly readings more engaging, immersive, and, ultimately rewarding and beneficial for students. If I could achieve this, students would read more and their learning, in terms of subject knowledge and wider academic skills, would improve.

2. Methodology

I contributed 4 lectures to the Part B Current Themes in Sport and Exercise Psychology module, a 20 credit Semester 2 class serving Psychology and Sport Science degree programmes. For each lecture, there are 3 compulsory readings identified as integral to the lecture content and holding relevance to the assessment. Readings are always scientific studies in peer-reviewed journals and thereby available in PDF format. Each week, I transformed 1 core reading into an immersive read (iREAD, see appendix A and B for full examples). By utilising the "add comment" function in Adobe Pro, I was able to highlight sections of text accompanied with a guiding comment to prompt student thinking. To add structure, comments addressed four key pillars; **knowledge, critique, application, and writing style**. These four pillars were based on **Subject Benchmark Statements** for Psychology.

It was important to me for the iREAD comments **not** to simply digest meaning and summarise content; providing a route to surface reading and skimming. Instead, I wanted comments to guide focus (e.g. "See how the two constructs differ here"), prompt thoughtful critique (e.g. "Are there any issues with the sample recruited?"), and encourage applied reflections (e.g. How might this change future coaching practice?"). Lastly, for writing style, I wanted students to gain appreciation for ***how*** content is communicated (e.g. "see how key definitions are given early in the subsection"). As such, the iREAD is not a spoon-feeding exercise, where I simply signpost and summarise to make reading quicker; but rather an interactive activity that takes longer to complete but is more enjoyable and involves deeper engagement.

3. Issues

Two minor technical issues emerged:

Formatting: Two (from 222) students informed me that the formatting on some comments was corrupted and that it was not always apparent which extract of text my comments pertained to. On exploring the problem further, the issue was resolved when the students opened the document on a different device – specifically a standard laptop PC. In future iterations of this practice, it will be important to clarify to students what the optimum viewing device is (e.g. personal laptop, University computer).

Audio versus text comments: It was my original intention to deliver each comment in both text and audio formats, with audio providing a more personal touch further supporting engagement. However, audio files could not be opened successfully. Resolving this issue with IT support may provide an additional layer of engagement and increase accessibility.

4. Benefits

Several benefits emerged from use of the iREADs. Student experience was enhanced as weekly core readings became engaging and enjoyable rather than burdensome and stressful. According to student feedback, the following direct benefits occurred: Deeper **engagement** with and enhanced **focus** on core reading. 1) A greater appreciation of **scientific critique** and **how to do it**. 2) **Increased motivation** to complete the readings. 3) iREADs support successful **engagement with regular readings**. 4) Increased **enjoyment** of reading and improved **subject knowledge**. 5) Readings more **inclusive** of students with specific learning needs (e.g., dyslexia).

5. Evidence of Success

Voluntary student response has been overwhelmingly positive. In summary, students reported deeper engagement with weekly readings, better critical comprehension, and increased focus and enjoyment. Collectively, students felt more motivated to read.

Specific student emails have stated:

1."*Being dyslexic, a large amount of text in front of me can be daunting… This is one of the first articles I have read this semester, without support from my study tutor, that I have felt I have taken in the relevant information and identified critiques.*"

2."*I feel they are hugely beneficial…it helps me to understand how I should be critiquing papers myself, and once I've got one reading under my belt that week, it doesn't seem as bad to tackle the others. So I wanted to say thank you for taking the extra time to do this as I massively appreciate this and I'm sure others do as well*."

3."*By having the additional comments has helped me to think more critically about the topics. By thinking more critically I find that I begin to look at other articles in a similar way, helping to further my understanding of the topics being discussed*."

4. "*I just wanted to let you know that I found the guided reading very helpful, it helped me not to get overwhelmed by the length of the articles and really challenged me to think deeper about certain areas rather than skimming over lots of areas. I would really like them to keep going and think this is something that would work in my other modules as well. Thank you for all your hard work and for going a step beyond the usual to help us all in this module*."

5. "*I am finding it easier to feel engaged with the reading as it is less overwhelming opening up a plain article with loads of plain text everywhere. The prompts make it easier to stimulate my thoughts on a particular area and create a deeper understanding of the content. Overall, I think it is a great idea and would love to see it continued. I am definitely feeling more motivated to read the articles that are guided than the articles that are not guided*."

6. "*The comments encouraged me to think more analytically with what I was reading and engage with the reading in a much deeper way, something which I often struggle to do. I found the comments were of a good frequency as they also encouraged me to look at all sections of the reading rather than just engage with the introduction and discussion*."

6. How Can Other Academics Reproduce This?

The iREAD tool has huge University-wide applicability. As comments are created by the lecturer for their own core readings, there are no subject disciplines to which this does not apply. It is important to develop a "How to" toolkit that enables academics to produce iREAD effectively with minimal impact on workload.

7. Reflections

I was extremely satisfied with the student response to this Case Study. The simplicity of the innovation, the ease of production and accessibility, and the fact it meets a genuine student need, are the biggest contributors to its success. The next steps involve consulting academic staff and students regarding the optimum number of comments per iREAD and the optimum number of iREADs per module (and whether this should differ according to year of study – e.g more in Part A). Consistency across modules will be important to manage expectations and discourage dependency.

8. References

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A comparison of four typical green exercise environments and prediction of psychological health outcomes

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Abstract

Aims: 'Green exercise' (GE) is physical activity while simultaneously being exposed to nature. GE comprises three physical components: the individual, the exercise and the environment, and one processes component encompassing a range of psychological and physiological processes. Previous research has consistently shown affective benefits of GE compared to equivalent non-GE. Investigating the possibility of optimum GE environments may help maximise health benefits. The aim of this study was to compare affective outcomes of GE participation between four different typical GE environments (beach, grasslands, riverside, heritage), and further examine influences of several physical component–related variables and one processes component–related variable, on these outcomes.

Method: Participants ($N = 331$) completed questionnaires before and after a 5km run, at one of four parkrun event locations.

Results: Self-esteem ($\Delta = 1.61$, 95% confidence interval (CI) = (1.30, 1.93)), stress ($\Delta = -2.36$, 95% CI = (–3.01, –1.71)) and mood ($\Delta = -5.25$, 95% CI = (–7.45, –3.05)) all significantly improved from pre- to post-run ($p < .05$). Improvements in these measures were not significantly different between environments. Several component-related variables significantly predicted these improvements, accounting for 9% of self-esteem improvement, 1.6% of perceived stress improvement, and 9.5% of mood improvement.

Conclusion: GE offers accessible provision for improving acute psychological wellbeing. Although nature-based exercise environments can facilitate affective outcomes, the overall type of nature may be less critical. Other characteristics of the individual, exercise and environment can significantly influence attainment of psychological GE benefits. However, the results support a greater importance of the processes component in attaining previously reported affective outcomes.

INTRODUCTION

Parks were designated and designed in the 19th century, informed by a belief that they might provide health benefits.[1] Indeed, contact with nature can provide an upstream health and wellbeing promotion intervention.[2] In public health, 'upstream' initiatives target prevention of health issues in order to avoid later need for treatments.[3] Contact with nature can be described in terms of the extent of engagement with nature.[4,5] 'Green exercise' (GE), a direct form of engagement, describes physical activity with a simultaneous exposure to nature.[6,7] A typical example could be running in a park. Acute bouts of exercise facilitate affective improvements[8,9] such as mood[10,11] and self-esteem.[12] Research articles and systematic reviews report that compared to exercising either indoors[13,14] or in built outdoor environments,[15] exercise in nature-based environments can lead to greater psychological benefits[16,17] and improvements in physiological measures such as blood pressure and immune function.[16,18]

The ecological dynamics approach offers an explanation for how GE improves psychological wellbeing. Compared to synthetic environments, natural environments provide more challenging, complex, varied and intense affordances

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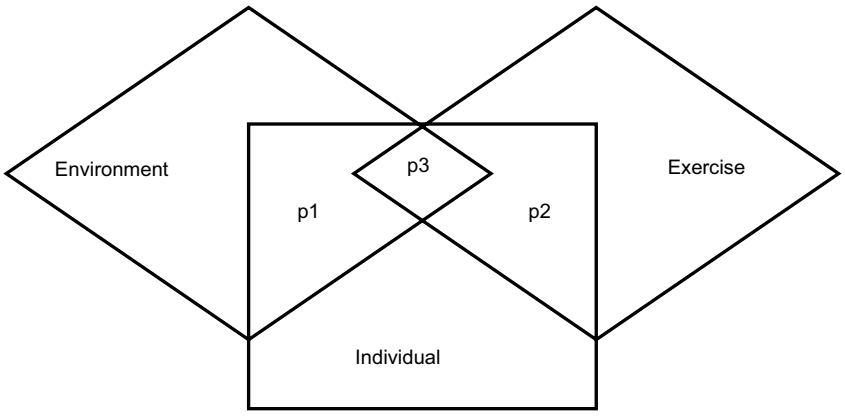
(invitations or possibilities),[19–21] whereby individuals can experience a broad range of emotions and other psychological feelings such as mindfulness, peace and calm.[20] This approach suggests that because laboratories afford different functional opportunities compared to natural environments, where possible, GE research should employ designs which prioritise the use of natural environments.[20] A number of studies have used opportunistic field sampling in order to examine GE participation via ecologically valid samples, reporting benefits to self-esteem and mood, across various GE activities such as horse riding and walking.[22–24] Barton and Pretty's meta-analysis of ten field sampling studies found that similar to exercise,[25,26] duration and intensity of exercise as well as age can influence GE outcomes.[24] However, other variables such as temperature and motivation for participation were not measured. Improvements in self-esteem (d = .46, 95% confidence interval (CI) = (0.34, 0.59)) and mood (d = .54, 95% CI = (0.38, 0.69)) resulting from acute bouts of GE are significant.[24] However, it is important to understand how to maximise these benefits in order to better direct the adoption of GE activities for psychological health in the wider public domain.

A framework for categorising and considering variables in relation to GE can be derived from Bandura's triadic model of reciprocal determinism and the ecological dynamics approach.[20,27] Figure 1 shows that GE has three physical components (categories of variables): individual, exercise and environment, and a fourth, interactive processes component. The processes component comprises psychological and physiological processes within the individual, in relation to the environment or the exercise, or both. Some stimuli and accompanying processes are mutually environment- and exercise-related (p3 area of Figure 1). For example, when running in nature, the stimulus of visual optic flow, as perceived by the individual, is a product of exercise-related motion through the environment.[28,29] The ecological dynamics approach views each of the individual, environment and exercise (task) parts as a system comprising a complex arrangement of factors (e.g. within the individual system: cognitive, affective and physiological states, physical flexibility, limb length). These factors can act as constraints which influence inter-system interactions by impacting whether and how the individual will perceive and act upon the functional affordances of an environment. In this way, the component-related variables referred to within the current study might also be thought of in terms of being constraints.

Figure 1

The four components (categories of variables) of green exercise: the three physical components, and the processes component (p1–p3)



Exploration of phenomenological experiences of GE activities[30] and the underpinning cognitive processes of GE affects[31–33] has provided an initial insight into the processes component. Age and gender appear to influence psychological outcomes, addressing the individual component.[24] Regarding the exercise component, intensity and duration of GE can influence affective outcomes.[17,24] Examining the environment component, perceived colour of the visual exercise-environment affects mood and perceived exertion.[31] Climatic conditions influence mood and cognition,[34] but such temporary variables are often not well-accounted for. Furthermore, few research studies have compared exercise outcomes between different nature environments, despite suggestions that the presence of water features within nature-based environments can enhance the effects of GE.[24,35] To better understand GE outcomes, the four GE components should be studied simultaneously.

The modern function of parks often includes usage by organised running groups who participate in set distance runs. This provides an ecologically valid opportunity to control or record relevant variables while measuring outcomes of GE participation. The aims of this study were to investigate potential differences in affective outcomes of running between different typical GE environments, and to provide an initial consideration of the importance of other variables in relation to these outcomes. We hypothesised that environments with greater presence of visible water features would facilitate the greatest improvements in affective states via GE participation. Our secondary hypothesis was that a number of other measured individual factors, and those related to the environment, the exercise undertaken and the processes component, would significantly predict psychological improvements.

METHODS

Participants

A convenience sample of 331 participants was recruited for this study (180 males, 151 females; age = 40.8 ± 12 years). Participants were attendees at four UK parkrun event locations (Gorleston Cliffs, N = 67; Nowton Park, Bury St Edmunds, N = 83;

Chelmsford Central Park, $N=100$; Colchester Castle, $N=81$). In order to produce variance in the environmental-component related measures of interest, data were collected on four separate dates at each event location, during September and November 2013. Adhering to Tabachnick and Fidell's[36] guideline that a case to independent variable (IV) ratio of 40 to 1 is reasonable for stepwise multiple regression (SMR) analysis, a minimum sample size of $N=300$ was sought in order to allow for a maximum of six IVs to be entered into each SMR.

'parkrun' and event locations

'parkrun' is a weekly, timed, 5km run which takes place in public spaces, across multiple locations both within the UK and internationally. It is branded as 'not about racing, it's about running', in order to encourage individuals of wide-ranging fitness to participate.[37] During the first six months of 2014, a mean of 243 ± 16 events were held in the UK each Saturday. The average combined weekly attendance to UK parkrun events for this period was 42,966 ± 6,006 individuals.

Event locations were selected to enable comparisons between different typical GE environments (beach, grasslands, riverside, heritage). Two criterion measures were used: (1) average number of attendees per week (selection criteria was a minimum average of 80 attendees) and (2) environmental characteristics of the 5km run route, in particular, the quantity of water content.

The environmental characteristics of each location were as follows. The beach route was along a pathway which tracks both along the top of cliffs (with views of the beach and sea to one side, and a road and buildings to the other) and along the beach pathway below. The grasslands route was within a park, with the majority of the route comprising grassland which bordered areas of woodland and was interspersed with trees; there was no view of water on this route. The riverside route tracked along pathways within an urban park. The majority of the route closely followed a river and although had frequent views of buildings, was predominantly maintained grass areas interspersed with trees. The heritage route tracked along pathways within a heritage park. The route in part tracked along a river and although in parts had views of buildings (including a castle), was predominantly maintained grass areas interspersed with trees and maintained flower beds. A greater proportion of the riverside route was in visible proximity to a river than the heritage route.

Design and procedure

At one of four locations, participants completed questionnaires immediately pre- and post-run, creating a mixed between–within design. On arrival, attendees were approached at random by a researcher and asked whether they would be willing to complete the two questionnaires; this was 5–35 minutes before the run commenced. Participants completed their post-run questionnaire within 10 minutes of crossing the finish line. The authors estimate that approximately 35% of approached attendees declined to participate.

Questionnaires were composite, comprising standard international measures of self-esteem (Rosenberg Self-esteem Scale (RSE)[38]), perceived stress (Perceived Stress Scale (PSS)[39]), mood (Profile of Mood States (POMS)[40,41]) and nature relatedness (Nature Relatedness Scale – short-form version[42]). Questionnaires also included bespoke menu-based questions regarding participants' primary motivation for attendance (the available options for this were: improving your fitness; improving your performance time; the social aspects of attending; getting outdoors for a while; other), membership of a running club (the options for this were: yes; no), and run performance in relation to their expectation (measured in the post-run questionnaire, the options for this were: I did better than I had expected; I did worse than I had expected; I did equally as well as to how I had expected; I did not have an expectation today). Participants' enjoyment of the run was measured in the post-run questionnaire using a 100mm visual analogue scale as a continuum from 0 – 'not at all' to 100 – 'very much'.

Collection of data on four dates at each location produced variance measures of the climatic environmental factors (temperature, cloud cover, rain). On each data collection date, new participants were sought. Where participants completed questionnaires on more than one date, only data from their first date was included in the analysis.

Measures

RSE[38] is a widely used ten item measure of psychological wellbeing within physical activity research,[43] which has been tested for cross-cultural universality.[44] Responses to items are made via four point Likert scale ratings from 'strongly agree' to 'strongly disagree'. Higher scores (maximum score = 30, minimum score = 0) indicate greater self-esteem. With reported Cronbach's alpha coefficients ranging from .77 to .88,[45,46] validity of the RSE scale is widely acknowledged.[47]

PSS[39,48] consists of ten statement items which measure an individual's appraisal of potentially stressful life situations. Its continued use has been supported following examination of its relative item invariance. The PSS has been correlated with stress measures, self-reported health, health behaviour measures, smoking status and help-seeking behaviour.[48] To adhere to the short-term nature of the current study, a modified version of the PSS was employed. Items were adjusted from statements such as 'In the last month, how often have you felt nervous and "stressed"?' to 'I feel nervous and "stressed"', with an accompanying instruction telling participants to 'indicate how you feel right now, at the moment'. Responses on the original PSS are made via Likert-type scales from 0 - 'Never' to 4 - 'Very Often'. The modified PSS for this study replaced this scale with descriptors of 0 - 'Strongly Disagree' to 4 - 'Strongly Agree'. Higher scores indicate a greater level of stress (maximum score = 40, minimum score = 0).

The shortened version of the POMS[40,41] requires individuals to describe how they feel 'right now' via responses to 30 single-word mood descriptor items, along at five point Likert-type scale. Five mood descriptor items represent one

subscale mood factor, and there are six subscale mood factors in total (anger, confusion, depression, fatigue, tension and vigour). Each mood descriptor's score ranges from 0 – 'Not at all' to 4 – 'Extremely', and for each subscale, raw scores are converted to T scores.[41] An overall mood score (Total Mood Disturbance (TMD)) is calculated by summing all the negative mood factors (tension, depression, anger, fatigue, confusion) and subtracting the positive vigour score. Higher TMD scores indicate poorer overall mood (maximum = 282, minimum = 112). POMS has been shown to have acceptable internal consistency with Cronbach's alpha values of .67–.93 and .84–.95 reported.[41,49] Validity and reliability tests show that a shortened version of the POMS is suitable for use in exercise contexts.[50]

The Nature Relatedness–6 (NR-6) is a short form of the Nature Relatedness Scale[42] which includes six items from the full questionnaire. Items are statements which the participant rates on a five point Likert-type scale from 1 – 'disagree strongly' to 5 – 'agree strongly'. In line with Nisbet *et al.*,[42] items were averaged to create a nature relatedness score. A higher score indicates a greater level of nature relatedness (maximum = 5, minimum = 0).

Other factors relating to the climate, individual and the exercise performed were also measured via questionnaire and collected from the parkrun website (Table 1). Participants' performance time (time taken to complete the run) and an age-adjusted performance level were obtained from the parkrun organisation's database. Age-adjusted performance was calculated by the parkrun organisation as an expression of participants' run completion time in relation to the 5km world record for their sex and age. Temperature and cloud cover percentage at 9a.m., and rainfall during the run were also recorded (Table 1).

Data treatment

For SMR analyses, the variable of 'primary motivation' was dichotomised into two categories: improving fitness (the most frequent response) and other reasons (created by collapsing all other options: improving your performance time; the social aspects of attending; getting outdoors for a while; other). The variable of 'expectation' was also dichotomised into two categories: I did better than I had expected (most frequent response) and other (created by collapsing all other options: I did worse than I had expected; I did equally as well as to how I had expected; I did not have an expectation today).

Statistical analysis

IBM SPSS version 19.0[51] software was used for all statistical analysis. An alpha level of .05 (two-sided) was employed to indicate statistical significance. For the primary hypothesis, mixed 4 (between (event location: beach, grasslands, riverside, heritage)) × 2 (within (time: pre-exercise, post-exercise)) analyses of variance (ANOVAs) compared change in the measures of RSE, PSS and TMD, according to location. Locations were ordinally ranked in terms of the proportion of the 5km route from which water was visible. A one-way within-subjects multivariate analysis of variance (MANOVA) analysed changes in subscale mood factors from pre- to post-run.

For the secondary hypothesis, SMRs examined the extent that individual-, environment- and exercise-component-related IVs (Table 1) were associated with the selected outcomes (RSE, PSS, TMD). Predictors were selected based on their strength of association with the pre- to post-exercise change in that measure. For each outcome, only statistically significant predictors were entered into an SMR. For the continuous-data variables, strengths of associations were indicated by beta values, calculated via simple linear regressions with the delta value for each selected measure (Table 2, online as supplementary material). For the dichotomised, categorical-data variables, strength of association was indicated by Cohen's *d*, obtained via independent sample *t*-tests on the delta values of each measure (Table 3, online as supplementary material).

RESULTS

Analysis of means

Although visual checks of frequency distributions suggested that data for the main measures (RSE, PSS, TMD) were normally distributed, assessment by Shapiro–Wilk tests for normality indicated that data was not normally distributed. However, non-normal distributions of data are unlikely to cause statistical problems for sample sizes greater than 40,[52] and normality of data distribution can be ignored for sample sizes of hundreds.[53] Indeed, parametric methods can be used even when data are not normally distributed.[54,55] Parametric methods were therefore used.

Mixed ANOVAs showed significant ($p < .001$) improvements from pre- to post-exercise for RSE (7.7% improvement; $F(1, 324) = 100.58$, $\eta_p^2 = .24$), PSS (18.4% improvement; $F(1, 315) = 50.78$, $\eta_p^2 = .139$) and TMD (14.2% improvement; $F(1, 278) = 22.15$, $\eta_p^2 = .07$) (Figure 2). There were no significant main effects for location ($p > .05$), or time by location interaction effects ($p > .05$) for any of the main measures.

A one-way within-subjects MANOVA showed a significant ($p < .001$) main effect for time on POMS subscale scores ($F(6, 276) = 51.13$, $\eta_p^2 = .526$). Univariate analyses showed that tension, depression, anger and confusion all significantly ($p < .001$) decreased from pre- to post-run. Vigour and fatigue significantly ($p < .001$) increased (Figure 3).

Prediction of outcomes

SMR showed that RSE improvement was predicted by enjoyment rating and performance in relation to expectation. Enjoyment rating was the primary predictor of ΔRSE, whereby each percent of greater enjoyment of the run explained 0.26% (B = 0.03, 95% CI = (0.02, 0.05)) of the improvement in self-esteem. Reporting 'better than expected' performance in relation to expectation was associated with greater RSE improvement (B = 0.86, 95% CI = (0.22, 1.50)) than was reporting one of the other collapsed options for this measure. This model accounted for 9% of the variance of RSE improvement. That is, participants who reported greatest enjoyment of the run and reported feeling that they performed 'better than expected' obtained 9% more benefit from their participation in terms of RSE than those who reported least enjoyment and reported feeling that they either performed worse than expected,

Table 1

Descriptive statistics for environment-, exercise- and individual-related variables.

Individual-related variables	Mean ± SD	Frequency	
Age (years)	40.8 ± 12.00		
Sex		Male – 54.4% (*n* = 180)	Female – 45.6% (*n* = 151)
Motivation for attendance		Improving fitness – 67% (*n* = 208)	Other – 33.3% (*n* = 104)
Club-runner		Club-runners – 33.8% (*n* = 112)	Non-club-runners – 66.2% (*n* = 219)
Performance expectation		Did better than expected – 40.2% (*n* = 132)	Other – 59.8% (*n* = 196)
Nature relatedness	3.71 ± 0.78		
Exercise-related variables			
Performance time (s)	1,642.15 ± 341.84		
Age-adjusted performance (%)	56.11 ± 9.60		
Environment-related variables			
Temperature (°C)	12.21 ± 4.00		
Cloud cover (%)	58.16 ± 30.11		
Rain during run (yes or no)		Rain – 2 events	No rain – 14 events
Processes-related variable			
Enjoyment rating (mm)	80.5 ± 19.3		

SD: standard deviation.
Age-adjusted performance: calculated by parkrun as a comparison of participants' run completion time against the 5km world record for the participant's sex and age (greater score % = better relative performance). Primary motivation for attendance: options for this were 'improving your fitness'; 'improving your performance time'; 'the social aspects of attending'; 'getting outdoors for a while'; 'other'. Enjoyment rating: visual analogue scale continuum from 0 mm – not at all, to 100 mm – very much. Performance expectation: how well participants felt that they performed in the run in relation to how they had expected to do – options for this were: 'I did better than I had expected'; 'I did worse than I had expected'; 'I did equally as well as to how I had expected'; 'I did not have an expectation today'. Nature relatedness: ranging from 0 to 5, higher scores indicate greater level of nature relatedness.

performed equally as well as expected, or did not have an expectation.

Only age-adjusted performance level predicted ΔPSS. Each percent lower of age-adjusted performance level was associated with 0.08% (95% CI = (0.01, 0.15)) of the reported improvement in PSS. This model accounted for 1.6% of variance in PSS improvement.

Nature relatedness, sex and enjoyment independently predicted improvement in TMD. Each percent of greater nature relatedness was associated with 3.68% (B = –3.68, 95% CI = (–6.40, –1.0)) of the reported improvement in TMD (as indicated by greater negative Δ value). Greater enjoyment of the run was associated with greater improvement in TMD (B = –0.15, 95% CI = (–0.24, –0.06)), and females reported greater improvement in TMD than males (B = –6.82, 95% CI = (–11.12, –2.51)). This model accounted for 9.5% of the variance of TMD improvement. That is, females who reported greatest levels of nature relatedness and greatest enjoyment obtained 9.5% more improvement in mood than did males who reported lowest nature relatedness and enjoyment.

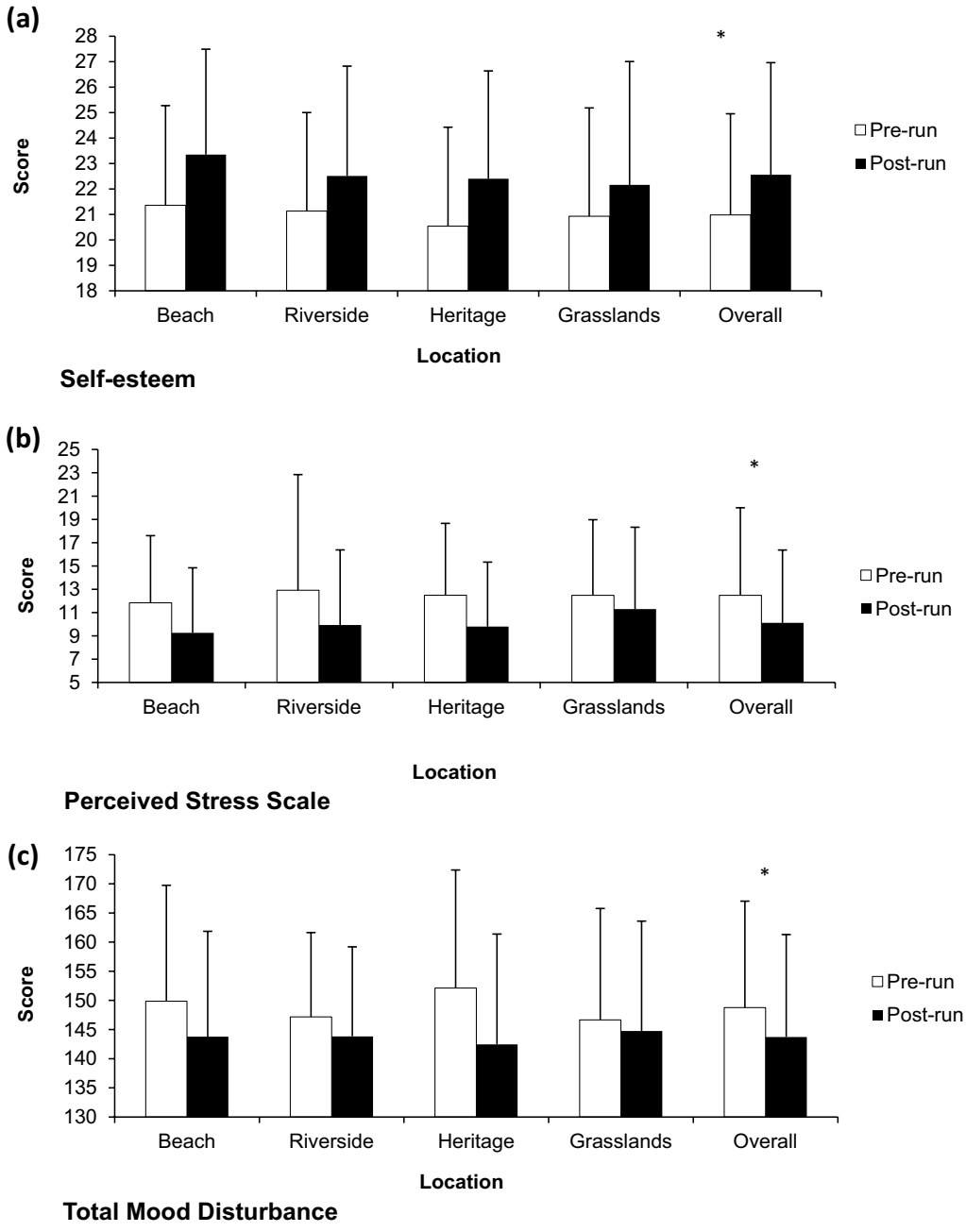
All tolerance values were greater than 0.9, indicating that there were no cases of significant multicollinearity for any of the multiple regression models.[36] Summary of regression models can be seen in Table 4.

DISCUSSION

parkrun participation increases sense of community and improves perceived fitness and mental wellbeing.[56] The current study aimed to determine potential sources of variation in these changes. To the authors' knowledge, this is the first study to rigorously examine the

Figure 2

Pre- and post-run scores for (a) RSE (higher score indicates greater self-esteem), (b) PSS (higher score indicates greater stress) and (c) POMS total mood disturbance (lower score indicates better mood)



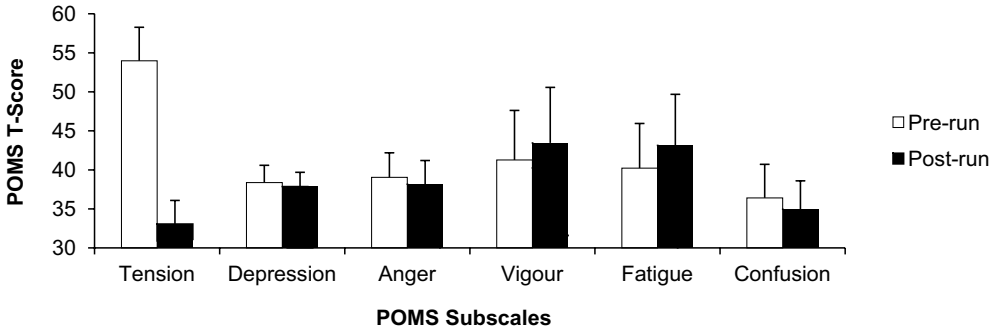
RSE: Rosenberg Self-esteem Scale; PSS: Perceived Stress Scale; POMS: Profile of Mood States.
*Indicates significant pre- to post-run improvement at an alpha level of .05.

importance of a range of factors relating to the individual, exercise, environmental and processes components, to GE health outcomes. The aims of the study were twofold – (1) to investigate whether psychological GE effects might differ according to the type of green setting (e.g. quantity of water) and (2) to investigate which individual-, environment-, exercise- and processes-related factors might predict GE health outcomes.

Consistent with previous research, a single bout of GE improved self-esteem by 7.7%, stress by 18.4% and mood by 14.2%.[23,24] The finding that GE improved TMD, tension, depression, anger, vigour and confusion is consistent with previous research.[23] Although these measures cannot indicate either the real term benefit to participants or the

Figure 3

Pre- and post-run differences in scores for POMS subscales (higher score indicates greater level of subscale mood state)



POMS: Profile of Mood States.

potential clinical significance, the findings demonstrate significant improvements in acute psychological wellbeing nonetheless, which in the short term may be used by health promotion initiatives.[57] Acute affective exercise outcomes influence longer term motivation for and adherence to exercise behaviours.[58–60] Here, GE participation might function as a tool for maintenance of exercise behaviours.[17] The worsening of POMS fatigue contradicts previous work. Timed 5km runs are likely to be more strenuous than the exercise of previous GE studies.[7,13,24,31] Greater exercise intensity may increase likelihood of participants interpreting items of the fatigue subscale ('fatigued, worn out, exhausted, sluggish, weary') as referring to physiological senses of these words, rather than the intended psychological sense.

Although exercise may have been more strenuous than that examined in previous GE studies, it seems likely that the intensity of exercise tended to be below ventilatory or lactate thresholds. Whereas intensities below these thresholds are associated with positive affective responses, for most recreational exercisers, intensities above these are associated with affective displeasure.[26] However, self-pacing of exercise facilitates greater tolerance of high intensities than does imposed pacing.[26] For some individuals, this may have buffered their overall affect from detrimental influences of high intensities.

Global self-esteem is typically considered to be a stable construct. However, acute effects of exercising in different environments on self-esteem have been reported.[17,24] As suggested by Fox's hierarchical model of physical self-perceptions in the physical domain,[61] the acute impact reported for global self-esteem was likely to have been contributed to by underpinning perceptual domains of sports competence and physical self-worth.[61] A limitation of the current study was that it did not additionally use the physical self-perception profile or a similar inventory to enable these domain and sub-domains to be fully considered.[62]

Our hypothesis that event locations with greatest presence of water features would facilitate greatest psychological improvements was not supported. Event location was not shown to influence the extent of the psychological improvements, despite differences in environmental characteristics. This is in contrast to previous evidence that the presence of water might enhance psychological affects of GE.[24,35] Although the beach route incorporated most water – with the sea visible along the entire route, buildings were also visible along much of the route, which may have been detrimental to affect.[7] The possibility that timed parkrun 5km exercise may have been more strenuous than previous GE studies is also important.[7,13,24,31] Environmental characteristics might be less influential at greater exercise intensities, as attention is focused more internally.[63,64]

The finding that outcomes were not different between typical GE environments can be interpreted in different ways. Considered in relation to previous research reporting GE to elicit comparatively greater psychological benefits than exercising either indoors[13,14] or in built outdoor environments,[15–17] this finding suggests that additional affective benefits may be universally obtainable across a range of GE environments. However, the current study did not include a non-nature-based comparison exercise-environment. Here, as acute affective benefits of single exercise bouts have been consistently reported,[8–11,65,66] it is not possible for the current study to decipher between the respective contributions of the 'greenness' of the exercise environments and the exercise per se. That is, similar affective benefits might have been gained by 'non-green' exercise.

A main strength of this study was its ecological validity. The results represent improvements in psychological wellbeing as observed from a real-world agency of individuals rather than of a designed and instructed intervention. Further strengths of this study were the control of exercise type and the rigorous accounting for component-related variables – a first within GE research using field sampling.[22–24] Our secondary hypothesis, that a number of such variables would predict psychological outcomes, was supported. Run enjoyment and performance in relation to expectation accounted for 9% of the variance in RSE

improvement. Furthermore, age-adjusted performance level accounted for 1.6% of the variance in improved stress. Individuals' nature relatedness, sex and enjoyment accounted for 9.5% of the variance in improved overall mood. The positive correlation of enjoyment with affective state outcomes from GE participation is consistent with the findings of Focht.[13] Enjoyment significantly predicting mood was anticipated, as enjoyment has been categorised as a tertiary emotion[67,68] and describes self-appraisals of emotional responses to an event.

As the individual system comprises personal characteristics which influence relationships with the environment, identification of the most relevant characteristics to beneficial outcomes of GE is important.[20] There was positive association between the individual component–related variable of nature relatedness and improvement in mood. As psychological wellbeing has been associated with individuals' relationships with nature,[69–71] it might also be expected that individuals who have the greatest level of nature relatedness would respond most positively to GE.[72] To the authors' knowledge, this is the first study to measure nature relatedness within GE research. That it accounted for a proportion of the improvement in mood suggests that this variable warrants inclusion in future examinations of GE.

Explanation of the negative association between age-adjusted performance level and perceived stress improvement is unclear. To speculate, a higher age-adjusted performance level might be indicative of greater focus on exercise cues and therefore less psychological engagement with the environment, which may limit affective benefits from environment-related semantic and episodic memory recall.

Less than 10% of the variance in the health measure improvements was predicted by the IVs, alluding to importance of processes component–related factors such as individuals' phenomenological experiences of both exercise and environment. The lived experience of exercise can be complex and difficult to measure.[73] Methods more complex than the quantitative approach of this study may offer greater scope for understanding and assigning meaning to occurrences within the 'black box' of the processes component, which underpin the reported outcomes. Phenomenological methodologies of interviews, written reports and auto-ethnography may be of use here.

The demonstrated inclusiveness of affective improvements is consistent with psycho-evolutionary perspectives, which suggest that via the evolutionary history of human experiences within nature environments, today's individuals are pre-disposed to positive psychological responses to nature environments, given an absence of perceived threat.[69,74–76]

GE improves self-esteem and mood and reduces feelings of stress, irrespective of the type of green setting. The findings advance previous understanding of the importance to GE outcomes, of specific individual-, environment- and exercise-related variables (constraints). Although a range of component-related variables can influence the attainment of GE benefits, much of the variance in the data was not explained by these. This suggests that large proportions of the psychological benefits of GE are universally obtainable, independent of demographic, performance level, climatic and other environmental characteristics. Considered with previous research, the implication of this finding is a reinforcement of confidence in the notion of prescribing GE participation, potentially above non-green equivalent exercise, for psychological health and wellbeing improvements. Such prescription can benefit a range of individuals without requiring specificity of green space type. Additionally, the findings allude that further examination of the processes component of GE is warranted.

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CONFLICTS OF INTEREST

Daniel Brown, Gavin Sandercock, John-James Wooler, and Jo Barton declare that they have no conflicts of interest. Mike Rogerson has no conflicts of interest other than holding a seat on parkrun's research board. He was appointed to this position only following the completion of this research.

ETHICAL APPROVAL

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration. Informed consent was obtained from all patients for being included in the study.

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Book Review

The Global War on Tobacco.

Edited by Heather Wipfli. Published by John Hopkins University Press, 2015. 240 pp. ISBN: 9781421416830

In her book *The Global War on Tobacco*, Heather Wipfli takes the first in-depth look at the development of World Health Organization's (WHO) Framework Convention on Tobacco Control (FCTC). As an employee with the Tobacco Free Initiative working on the development of the FCTC, Wipfli brings an insider's perspective and an authority to the narrative.

The book is in two parts: first, it considers the political and commercial history of the tobacco industry and of tobacco control, exploring the impact of globalisation on maintaining the tobacco market despite decreasing use in the developed world, but also how globalisation has facilitated international action on tobacco in a way that hasn't been seen in any other area of public health practice.

The second section contains case studies of how the FCTC has been implemented in four contrasting countries: Uruguay, Thailand, Germany and China. These case studies give a fascinating insight into the different approaches to the FCTC, from Thailand's vocal support from its inception, to Germany and China's opposition and their apparent aim to protect the tobacco industry. Uruguay's interesting narrative showed how the FCTC provided the impetus and the regulatory framework to enable it to 'transform from a global tobacco control dissenter to the first country in the world to implement nearly every one of the FCTC obligations and nearly all recommendations' (Wipfli, 2015, p. 115).

This is a well written and engaging book on a topic that could, at first, appear dry and heavy going. The author does not assume a prior knowledge of the tobacco control arena, and this would be a useful introduction for those new to working in the field.

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Eating disorder prevention initiatives for athletes: A review

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REVIEW ARTICLE

Eating disorder prevention initiatives for athletes: A review

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Abstract
A substantial amount of evidence suggests that collegiate and elite athletes involved in weight-sensitive sports are at greater risk of developing eating disorders (EDs) than the general population. With the limited effectiveness of treatment for EDs, prevention of EDs has been broadly considered in the literature. The present paper reviewed the existing literature on ED prevention programmes for athletes in order to determine the current status of prevention programmes and recommend future directions. The available literature suggests that selective, primary interventions with multiple targets and an interactive multimodal approach appear most effective. Current challenges in the field, including lack of longitudinal research, hesitation by the sport community to be involved in ED research and poor cross-field communication and collaboration, are also explored. The lack of dissemination of evidence-based prevention programmes and the simultaneous promotion of prevention programmes that have not yet been empirically examined are also discussed. Based on these observations future directions are recommended.

Keywords: *Eating disorder, prevention, athlete, sport psychology*

This paper examines the current status of eating disorder (ED) prevention programmes targeting athletes to better direct future initiatives in the field. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) categorises EDs into several specific types, including: anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED) and other specified feeding or eating disorder (OSFED; American Psychiatric Association [APA], 2013). Diagnostic features of AN include restriction of energy intake leading to significantly low body weight for age, sex, developmental trajectory and physical health, an intense fear of gaining weight, and disturbances in the way in which one's body weight or shape are experienced (APA, 2013). Diagnostic features of BN include recurrent episodes of binge eating, inappropriate compensatory behaviours to avoid weight gain (e.g. self-induced vomiting, laxatives, excessive exercise) and self-evaluation disproportionately linked to body shape and weight (APA, 2013). Features of BED include recurrent episodes of binge eating, marked distress associated with binge eating and a lack of recurrent use of inappropriate compensatory behaviours. A diagnosis of OSFED is provided in clear cases of EDs that do not meet the full criteria of a specific feeding or ED (APA, 2013). EDs are associated with medical issues such as permanent loss of bone mineral density, and psychological distress, including depressed mood (APA, 2013). As well, EDs have a higher mortality rate than any other mental disorder (Arcelus, Mitchell, Wales, & Neilsen, 2011; Nielsen et al., 1998; Sullivan, 1995).

Disordered eating (DE) broadly refers to maladaptive eating behaviours (Bonci et al., 2008) and has been conceptualised on a continuum from dieting to clinical EDs (Sundgot-Borgen & Torstveit, 2010). DE and body dissatisfaction, conceptualised as poor subjective evaluation of one's body (Lloyd-Richardson, King, Forsyth, & Clark, 2000; Sonneville et al., 2012), are both thought to increase vulnerability for the development of an ED. Participation in regular physical activity has been typically associated with greater body satisfaction (e.g. Malinauskas, Cuchiarra, & Bruening, 2005; Wilkins, Boland, & Albinson, 1991); however, both male and female

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athletes at the collegiate and elite level experience DE at higher rates than non-athletes (Petrie & Greenleaf, 2011). For example, up to 70% of elite athletes competing in weight class sports engage in dieting as well as other physiologically risky behaviours (e.g. laxative abuse) to lose weight for competition (Oppliger, Case, Horswill, Landry, & Shelter, 1996; Torstveit & Sundgot-Borgen, 2005). These findings suggest that although some components of sport activity may actually protect against the development of EDs, others appear to increase the risk. Specifically, athletes participating at the elite level and those involved in weight-sensitive sports have been found to be at increased risk of developing an ED (Krentz & Warschburger, 2011; Smolak, Murnen, & Ruble, 2000; Sundgot-Borgen & Torstveit, 2004; Torstveit, Rosenvinge, & Sundgot-Borgen, 2008). If a large majority of weight class athletes engage in such behaviours, these behaviours may be seen by the sport world as somewhat acceptable, if not adaptive, to winning. This makes diagnosing EDs in athletes a particular challenge, as clinicians must determine, for example, what constitutes an "excessive" amount of exercise for an elite athlete.

In addition to clinical EDs, athletes are also at risk of developing a syndrome now referred to as Relative Energy Deficiency in Sport (RED-S; Mountjoy et al., 2014). The International Olympic Committee recently replaced Female Athlete Triad (FAT) with RED-S to more accurately capture the cluster of symptoms that both female and male athletes are at risk of developing as a result of an imbalance of energy expenditure versus energy intake. RED-S symptoms include (but are not limited to) impaired metabolic rate, menstrual function, bone health immunity, protein synthesis and cardiovascular health (Mountjoy et al., 2014). DE may account for a large majority of RED-S cases; however, mismanaged energy intake and expenditure may also be a cause (Loucks, 2004).

While any athlete may be at risk of RED-S, certain sports have been identified as posing a particularly high risk for the development of EDs. These high-risk sports have been conceptualised in the literature in a variety of different ways; however, broadly, they are considered weight-sensitive sports. Three specific classifications appear to most succinctly describe the spectrum (Ackland et al., 2012; Sundgot-Borgen et al., 2013): (1) *Aesthetic sports* are those in which physical appearance is a fundamental component of judging criteria. These include sports such as gymnastics, figure skating and dance, which typically value and reward thin, long lines; (2) *Weight class sports* are those in which athletes' weight determines the category in which they will compete. These include sports such as judo, wrestling and boxing; (3) *Gravitational sports* are those in which low body weight may improve performance. This category includes sports such as running, cycling, swimming and horse racing.

A large study comparing prevalence rates of EDs in a sample of 1620 elite athletes and 1696 non-athletes found a higher prevalence rate of EDs in the elite athletes (13.5% versus 4.6%, $p < 0.001$); however, for the most part, this finding was specific to athletes participating in sports considered "high risk" according to the aforementioned categories (Sundgot-Borgen & Torstveit, 2004). While EDs can and do occur in elite athletes participating in lower risk sports (e.g. basketball or football) as well as in recreational/amateur athletes, the increased risk of EDs among elite athletes participating in "high risk" categories of sport suggests the need for greater attention to the prevention and treatment of this unique sub-group of the population. Given the limited efficacy of many ED treatment programmes, as well as relatively high relapse rates following treatment (Fairburn, 2005; Fairburn, Norman, Welch, O'Connor, Doll, & Peveler, 1995), the majority of experts in the field appear to support the notion that the best form of treatment in athlete populations is prevention (Becker, McDaniel, Bull, Powell, & McIntyre, 2012; Dosil, 2008).

ED prevention

The Committee on the Prevention of Mental Disorders defines prevention as "interventions that occur before the initial onset of a clinically diagnosable disorder" (Muñoz, Mrazek, & Haggerty, 1996, p. 1118). They recommend that researchers conceptualise prevention studies as either universal, selective or indicated (Muñoz, Mrazek, & Haggerty, 1996). *Universal* prevention interventions target the general population, *selective* prevention interventions target those at greater than average risk of developing a mental disorder, and *indicated* prevention interventions target high-risk individuals (e.g. those with predisposing biological markers or detectable symptoms of a mental disorder that do not yet meet diagnostic criteria; Muñoz, Mrazek, & Haggerty, 1996). Piran, Levine, and Steiner-Adair (1999) further conceptualise ED prevention approaches by referring to programmes aimed at reducing the incidence of new cases of EDs as *primary* prevention, programmes addressing early symptoms of ED behaviour as *secondary* prevention and programmes focusing on the rehabilitation of persons experiencing clinically significant EDs as *tertiary* prevention.

Over the last three decades, a plethora of research has examined the effectiveness of universal ED prevention programmes. Stice and Shaw (2004) conducted a meta-analytic review of ED prevention programmes and discovered that all programmes that reduced current or future ED symptoms used interactive as opposed to didactic approaches. These

programmes included interactive exercises focusing on risk factors for eating pathology (e.g. body dissatisfaction) and discussions of the social pressures of thinness and weight control. This observation was consistent with a meta-analysis of substance abuse prevention programmes that similarly found interactive programmes to be the most effective approach (Tobler et al., 2000). Collectively, these studies suggest that engagement and interaction with participants is required in order for prevention programmes to have any significant lasting effects.

In a subsequent meta-analysis, Stice, Shaw, and Marti (2007) reviewed 68 controlled trials of ED prevention programmes conducted between 1980 and 2006. They found that 51% of the ED prevention programmes reviewed were effective in reducing some of the risk factors associated with EDs. These included body dissatisfaction, dieting, thin-ideal internalisation, negative affect and/or DE. However, only 29% of the prevention programmes examined reductions in current or future eating pathology. Larger effects were found for selective versus universal prevention approaches, interactive versus didactic approaches and multi-session versus single session prevention programmes (Stice et al., 2007). In addition, gender-matched programmes, programmes targeting participants over age 15 and programmes facilitated by external professionals (versus someone familiar to participants) also exhibited larger effects (Stice et al., 2007).

ED prevention in athletes

The meta-analytic findings described above provide promising and important directions for the development of future ED prevention programmes. Notably, the strong support that has been found for selective versus universal prevention programmes suggests that targeting higher risk populations (e.g. athletes) could prove to be an effective prevention strategy. The present paper sought to review the existing literature on ED prevention programmes for athletes in order to determine the current status of prevention programmes and recommend future directions.

Method. To identify empirical studies that have examined ED prevention programmes for athletes, a review was conducted in October 2014 using PsycINFO and PubMed-MEDline. The following search terms were used: "prevention" or "intervention" in the abstract, and "athlete" or "dancer", and "eating disorder" or "disordered eating" anywhere in the text. In total, 145 unique references were identified. Of these articles, 11 were peer-reviewed studies that had implemented and tested an ED prevention initiative for a group of athletes (see Tables I and II for the outcomes of studies examining prevention initiatives in adolescents and adults, respectively, and Table III for additional information about outcome measures).

Table I. Studies evaluating ED prevention interventions for athletes aged 18 and under

Author	Participants	Outcome measures	Summary of findings
Buchholz et al. (2008)	31 female competitive gymnasts (aged 11–18), parents and coaches, from 7 gymnastic clubs	Subscale of CISSS, BESAA, EAT-26, SATAQ, SEOD and PEAQ	Reduction in pressure to be thin found in intervention group and not found in controls. No other effects of the intervention found.
Doyle-Lucas and Davy (2011)	321 ballet students (aged 13–18) from 7 professional dance companies' summer intensive training programs	Demographic questionnaire, SNKBQ[a], FFQ[a]	Intervention group increased nutritional knowledge, perceived risk of FAT and self-efficacy.
Elliot et al. (2004, 2006, 2008), Ranby et al. (2009)	928 female students from 40 sport teams (mean age 15.4)	15 constructs based on those used in Goldberg and colleagues (2000) plus items from the EAT-26[a]	Reduced diet pill use and performance enhancing substance use found following the intervention and at—one to three-year follow-up.
Kaufman et al. (1996)	39 students (only eight non-controls) from a professional ballet school (aged 13–17)	EAT-26 and OSIQ	No significant benefits were found for participants.
Martinsen et al. (2014)	465 first-year students from 16 Norwegian Elite Sport High Schools	DSM-IV ED criteria, EDI-2, CSE	In females, no new cases of EDs in intervention group were found while 13% of controls developed EDs. Risk reduction for dieting was also found in intervention participants.
Piran (1999)	120–126 professional ballet school students (aged 10–18)	DSED, EAT-26 and EDI (DT, Bul., BD subscales)	In females, reductions in: bingeing; vomiting; and laxative use; patterns of restrictive eating, and enhanced attitudes toward the body were reported.

[a]No available investigation of the validity of this measure as used in this study.

Table II. Studies evaluating ED prevention interventions for athletes aged 18 and older

Author	Participants	Outcome measures	Summary of findings
Abood and Black (2000)	70 female college athletes from 7 different university sports	EDI-2, RSES, SCAT, SAS, Nutrition beliefs and knowledge inventory[a]	Participants in the intervention group experienced significant decreases in Drive for Thinness and Body Dissatisfaction (EDI subscales). Control group experienced a decrease in self-esteem and nutritional knowledge.
Becker et al. (2012)	157 female athletes (aged 18–22) from nine varsity sport and varsity cheerleading squads from a NCAA III university	IBSSR, DRES, shape, weight and bulimic diagnostic items from the EDE-Q, fear, guilt and sadness subscales from the PANAS-X	Both interventions reduced thin-ideal internalisation, dietary restraint, bulimic pathology, shape concern and negative affect after six weeks, and bulimic pathology, shape concern and negative affect at one year. The Healthy-weight intervention was preferred by athletes.
Baer et al. (1995)	12 college athletes, recommended to program if suspected to be engaging in DE behaviours	Not specified[a]	Increased consumption of carbohydrates, non-caffeinated drinks, and intake of iron and calcium (females only) found in participants.
Smith and Petrie (2008)	29 body-dissatisfied Division I female collegiate athletes (mean age 19.32)	BAA-R, BPSS-R, PANAS-X, BULIT-R, DRES	No overall time × intervention effects. Benefits of the cognitive dissonance intervention for: depression; internalisation of physically fit and in-shape body type; and increase in body satisfaction.
Torres-McGehee et al. (2011)	40 female collegiate auxiliary dancers (aged 18–25)	Demographics, EDI-3, subscales (Lst, Perf, Mf), CES-D, EDKQ and NKS (specific to athletes and dancers).	Significant increases in nutritional and ED knowledge and decreases in depression and EDI-3 scores were found.

[a]No available investigation of the validity of this measure as used in this study.

ED prevention programs empirically examined in athletes. Although research has highlighted the potential benefits of selective prevention programmes, examination of the existing literature indicates that very little research conducted to date has assessed the effectiveness of selective ED prevention programmes in athlete populations specifically (Becker et al., 2012; Smith & Petrie, 2008).

In early attempts to prevent EDs in athletes, the University of Cincinnati initiated a DE response team for athletes at risk (Baer, Walker, & Grossman, 1995). The team included athletic trainers, a physician, a dietician and a psychologist to assess, monitor and provide education and support to athletes at risk. This selective, primary-intervention initiative saw 12 athletes in its first year. The research team reported that the programme was successful in modifying dietary behaviours of participants, including increased consumption of carbohydrates, non-caffeinated fluids and intake of iron and calcium in females. In contrast, a two-year, selective, primary, didactic intervention targeting professional ballet students was not associated with improvements (Kaufman, Warren, & Hamilton, 1996).

Piran (1999) implemented a more comprehensive, decade-long prevention programme at a professional ballet school for dancers. It was a selective intervention with primary, secondary and tertiary levels. The main intervention included small groups (6–20) of age and gender-matched students who met with Piran 2–10 times annually to discuss their experiences with body shape and weight. Administration and staff at the school also met with Piran to help inform and direct the prevention programme. These sessions helped to identify systematic factors within the school's environment that contributed to body weight and shape preoccupation and facilitated several systematic changes in the school. For example, rather than focusing on body shape, the school shifted its emphasis to stamina and body conditioning. Over the course of the prevention programme, the ballet students reported significant improvements in DE patterns and attitudes about eating and body shape, as well as an increase in healthy eating habits (Piran, 1999). These findings support the notion that systematic long-term ED prevention programmes targeting high-risk athletes, specifically ballet dancers, can effectively reduce ED symptomatology.

Table III. Outcome measures used in studies reviewed

Abbreviation	Test	Reference
BAA-R	Beliefs About Attractiveness Scale-Revised	Petrie, Rogers, Johnson, and Diehl (1996)
BESAA	Body-Esteem Scale for Adolescents and Adults	Mendelson, Mendelson, and White (2001)
BPSS-R	Body Parts Satisfaction Scale-Revised	Petrie, Tripp, and Harvey (2002)
BULIT-R	Bulimia Test-Revised	Thelen, Mintz, and Van derWal (1996)
CES-D	Centre for Epidemiological Studies – Depression	Radloff (1977)
CISSS	Climate in Sport Setting Scale	Buchholz, Mack, Steringa, and Matthias (2003)
CSE	Contingent Self-Esteem Scale	Kernis (2003)
DRES	Dutch Restrained Eating Scale	Van Strien, Frijters, Van Staveren, and Defares (1986)
DSED	Diagnostic Survey for Eating Disorders	Johnson (1985)
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders IV	APA (1994)
EAT-26	Eating Attitudes Test	Garner, Olmstead, Bohr, and Garfinkel (1982)
EDE-Q	Eating Disorder Examination Questionnaire	Fairburn and Bèglin (1994)
EDI – 2, 3 (Lst, Perf, Mf)	Eating Disorder Inventory (Low self-esteem, Perfectionism, and Maturity Fears subscales)	Garner, Olmstead, and Polivy (1983), Garner (2004)
EDKQ	Eating Disorder Knowledge Questionnaire	Turk, Prentice, Chappell, and Shields (1999)
FFQ	Food Frequency Questionnaire	Doyle-Lucas and Davy (2011)
IBSSR	Ideal Body Stereotype Scale-Revised	Stice and Agras (1998)
NKS	Nutrition Knowledge Survey	Shifflett, Timm, and Kahanov (2002)
OSIQ	Offer Self-Image Questionnaire	Offer, Ostrov, and Howard (1982)
PANAS-X	Positive Affect and Negative Affect Schedule-Revised	Watson and Clark (1992)
PEAQ	Parental Eating Attitudes Questionnaire	Buchholz and White (1996)
RSES	Rosenberg Self-Esteem Scale	Rosenberg (1965)
SAS	Self-Rating Anxiety Scale	Zung (1971)
SATAQ	Sociocultural Attitudes Towards Appearance Questionnaire	Heinberg, Thompson, and Stormer (1995)
SCAT	Sport Competition Anxiety Test	Martens, Vealey, and Burton (1990)
SEOD	Self-Efficacy over Dieting	Neumark-Sztainer, Sherwood, Coller, and Hannona (2000)
SNKBQ	Sports Nutrition Knowledge and Behavior Questionnaire	Doyle-Lucas and Davy (2011)

Abood and Black (2000) conducted an eight-week health education intervention for a group of female college athletes involved in seven different sports. Rather than focus on pathogenic weight loss methods, the programme focused on educating participants about health topics relevant to athletes. The structure of this selective and primary intervention was guided by available literature and by consultation with an athletic trainer from the college with experience providing psycho-education to the athletes. It included two sessions each on self-esteem, stress management, nutrition and goal setting. Both qualitative and quantitative results indicated that the programme had positive effects on the athletes, suggesting that psycho-education alone has the potential to be a valuable tool to reach competitive athletes. However, the long-term effects of the intervention were not assessed, making it difficult to determine whether the athletes were able to apply the knowledge obtained during the intervention to their athletic careers.

Elliot and colleagues (2004) conducted a study examining the ATHENA (Athletes Targeting Healthy Exercise and Nutrition Alternatives) prevention programme for a variety of athletes in 18 public high schools. This universal and primary intervention was an eight-session programme incorporated into teams' usual practice activities with the objective of reducing female athletes' DE habits and to discourage the use of body-shaping substances (Elliot et al., 2004). The peer-led, team-based approach to prevention significantly reduced behaviours associated with EDs among female athletes, as well as other health-harming behaviours (Elliot et al., 2004). These promising findings remained significant one to three years following graduation (Elliot et al., 2008).

Based on Elliot and colleagues ATHENA programme, Torres-McGehee and colleagues (2011) implemented a modified version of the programme for collegiate auxiliary dancers (e.g. cheerleaders, majorettes, colour guards and spirit squads), who may also be at higher risk for developing EDs (Torres-McGehee et al., 2011). Findings of the study suggest that the programme was effective at increasing knowledge regarding nutrition and EDs. At posttest, participants in the programme reported improvements in depression, drive for thinness, body dissatisfaction and maturity fears, whereas participants in the control group did not report such

changes. These findings suggest that the ATHENA programme holds promise as an ED prevention intervention for a variety of athletes.

Smith and Petrie (2008) conducted a study with a group of female collegiate athletes and compared a selective, primary, cognitive dissonance intervention to two alternatives: a psycho-education approach and a control group. The authors reported that the cognitive dissonance intervention, aimed at addressing inconsistent cognitions (e.g. thin-idealisation versus ideal body for performance in sport), was effective in increasing body satisfaction amongst its participants. However, the difference between groups was not statistically significant, likely owing to the small sample size in their study (29 female athletes; Smith & Petrie, 2008).

More recently, Becker and colleagues (2012) explored the effectiveness of a selective, primary, cognitive dissonance intervention in female college athletes by comparing a unique "athlete-modified" dissonance prevention approach to an "athlete-modified" healthy weight intervention. The healthy weight intervention, which had previously been found to reduce ED risk factors in adolescent females (Stice, Marti, Spoor, Presnell, & Shaw, 2008), focused on encouraging small lifestyle changes to help maintain a healthy weight (Becker et al., 2012). Both prevention approaches examined by Becker and colleagues (2012) reduced ED risk factors at six-week and one-year follow-ups. These results are quite promising; however, a larger replication study is warranted given the relatively homogenous sample (168 female athletes attending one university).

The BodySense project was developed as a selective, primary, positive body image initiative aimed at facilitating a positive body climate for female athletes and their athletic clubs (Buchholz, Mack, McVey, Feder, & Barrowmen, 2008). The workshops focused on issues such as eating attitudes and beliefs, health, self-esteem and stress management in sport, and they were designed for athletes, coaches and parents. An empirical investigation of the BodySense project noted a modest reduction in athletes' perceptions of pressure from sport clubs to be thin at post-intervention (Buchholz et al., 2008), but unfortunately no replication or follow-up studies have been conducted to examine the generalisability of the findings or the maintenance of change.

Doyle-Lucas and Davy (2011) developed the "Nutrition for Optimal Performance" intervention for pre-professional adolescent ballet dancers. The programme included three 30-minute sessions aimed at educating dancers about basic sport nutrition and FAT and encouraged healthier dietary habits by increasing self-efficacy. The selective, primary educational sessions were presented in a DVD format. Results demonstrated that the intervention increased nutritional knowledge, perceived susceptibility to FAT and self-efficacy. Although the study demonstrated the potential ability to disseminate standard interventions to a wide audience (through DVDs), it only included a six-week follow-up period and declines were already found at this stage. Thus, an exploration of the long-term impact of this type of intervention would be worthwhile.

Most recently, Martinsen and colleagues (2014) implemented a one-year intervention for first-year students at Norwegian Elite Sport High Schools. The selective, primary intervention used lectures, teamwork and practical and theoretical skills assignments to convey information. Topics included self-esteem, self-confidence, motivation, growth and development, restitution, sport nutrition, EDs in relation to health and performance. Similar to the study by Piran (1999), the authors also engaged coaches in the initiative. Seminars were arranged to educate coaches about self-esteem, self-efficacy, mental training, sports nutrition, body composition, weight issues and how to identify and manage DE and EDs amongst athletes. Additionally, the authors used the Internet and social media to engage the students online. Main results of the study indicated that no new cases of EDs had developed in the intervention group during the course of the study. This is in stark contrast to the 13% of female athletes in control schools that developed *DSM-IV* EDs over the same period of time. This is promising, as it suggests that EDs may be prevented in athletes using systematic, multi-dimensional approaches. Replication and further investigation of the intervention used in this study should therefore be encouraged across a variety of athlete training settings to determine its generalisability.

Although the literature on the effects of ED prevention programmes for athletes is still somewhat limited, accumulating evidence suggests that selective ED prevention programmes directed at high-risk athletes appear promising in their ability to reduce risk factors associated with EDs. What is notably lacking in the literature are empirical studies examining the mechanisms of change in ED prevention programmes and prospective studies assessing the long-term impact of these prevention programmes in high-risk athletes. For example, Piran's (1999) impressive, multi-faceted prevention programme which spanned an entire decade and improved ballet dancers' eating habits and attitudes towards weight and shape tells us little about how these dancers-in-training faired when they entered the professional dance world. Research has not yet examined how these prevention programmes may affect an athlete's long-term experience with eating, body weight and shape, thus highlighting a crucial gap in

the literature. Long-term follow-up studies of effective interventions could potentially provide insight into whether these prevention initiatives affected lifetime prevalence of ED symptomatology in the athletes they targeted.

ED prevention programs awaiting empirical examination in athletes. In addition to the aforementioned published prevention studies, several ED prevention programmes have been implemented which appear promising, but have not yet been empirically examined in published research. For example, the following intervention initiatives were identified in Thompson and Sherman's *Eating Disorders in Sport* (2010) but do not appear to have been examined empirically.

The Athletes@Risk programme (Women's College Hospital, 2013) was designed to reduce the incidence of FAT (which could now be referred to as RED-S). Beyond educating female athletes about the triad, the programme, which is divided into five interactive workshops, focuses on healthy eating habits, positive self-esteem and body image, safe training practices and stress management (Thompson & Sherman, 2010; Women's College Hospital, 2013). The New York State Public High School Athletic Association has also been running an ED prevention programme for physically active females since 1999 (New York State Public High School Athletic Association [NYSPHSAA], 2013). Similar to the Athletes@Risk programme, this programme appears to focus on increasing awareness of the risks of FAT, as well as promoting body satisfaction and mental health amongst female athletes. Although these programmes appear promising given that they target high-risk populations and take an interactive approach, published data on the effectiveness of these programmes are not yet available.

Discussion

The current paper sought to review the existing literature on ED prevention programmes for athletes in order to assess the current status of prevention programmes and recommend future directions. The findings of the review suggest that ED prevention programmes for athletes hold promise. However, the body of literature is still quite small, and follow-up studies and replication studies of the prevention programmes resulting in positive outcomes (e.g. Martinsen et al., 2014; Piran, 1999) need to be conducted. Process research would also help to elucidate the components of these programmes that are most effective, thus allowing for further refinement of already effective interventions.

It is evident from the existing studies that certain elements appear to be common among the successful interventions, suggesting that these components likely play a role in the effectiveness of these interventions. These include programmes with multiple targets for systematic change and interactive programmes with a multi-model approach. Programmes such as Piran's (1999) and Martinsen and colleagues' (2014) not only targeted athletes but also coaches and sport administration. By doing so, it is possible that the athletes felt that their coaches were supporting the messages they were receiving from the intervention and/or that the information received by the coaches provided them with knowledge and skills to better support their athletes. In addition to having multiple targets (e.g. athletes and coaches), effective prevention programmes also tend to be interactive, by encouraging multiple modes of communication. For example, beyond psycho-education, Elliot and colleagues' (2004) ATHENA programme encouraged participants to lead at least 70% of the sessions. Martinsen and colleagues (2014) assigned practical skills assignments, and Piran (1999) provided a safe space for the athletes to express their experiences of body shape and weight, which helped to guide the direction of the programme's focus groups.

It is worth noting that the majority of the effective interventions reviewed in this paper targeted athletes 18 years old or younger. As well, while 6 out of the 11 papers looked at athletes under 18, the other five studies looked at collegiate athletes, which for some sports may still be a relatively young sample. While there could be a variety of reasons for the literature's focus on younger athletes, it is possible that this age group is easiest to target, and also that it is most helpful to deliver prevention programmes while athletes are still young and before they start developing ED symptoms. It would be helpful to examine the generalisability of ED prevention programmes by assessing their effectiveness in more seasoned adult athletes.

Application of knowledge. Implementing evidence-based prevention initiatives into athletes' training curriculum would be an ideal approach to systematically reduce rates of DE and EDs in athletes. It would also provide the opportunity to explore the ecological validity of effective interventions when applied in alternative training settings. However, before offering recommendations for future ED prevention programmes for athletes, it is important to consider some of the barriers to systematically implementing ED prevention initiatives in athlete training programmes.

There appears to be a gap between empirical investigations and actual implementation of ED prevention programmes aimed at high-risk athletes. Although a variety of empirically examined approaches hold much promise, subsequent implementation and dissemination of these prevention

programmes over the long-term is lacking, impeding further investigation and understanding of these approaches. On the other hand, a variety of prevention programmes have been implemented in recent years, and although some appear promising, empirical studies have not yet been conducted to support their effectiveness. This gap between research and practice in prevention initiatives aimed at athletes is concerning given the additional risks this sub-group of the population faces.

A variety of challenges may be hindering progress in the empirical investigation and/or implementation of ED prevention programmes for athletes. First, attempts to access sport institutions and/or recruit athletes into ED prevention initiatives may be met with resistance. While sport organisations and their athletes may be keen to promote themselves as models of positive body image, they may be understandably more reluctant to be associated with programmes addressing the risk of EDs in their athletes (Buchholz et al., 2008). Thus, researchers seeking access to athletes should be aware of the importance of image in the sport world and sensitive to how their research studies are portrayed when attempting to recruit athletes.

Second, coaches and athletes may not agree that dietary restriction and/or low weight are pathological within the context of their sport. Dieting, weight loss and excessive exercise are often viewed as desirable in sports with weight restrictions or an emphasis on leanness (Thompson & Sherman, 2010). This discrepancy between clinicians' and researchers' conception of ideal eating and exercise practices on the one hand, and athletes' and coaches' conception of eating and exercise on the other hand, may pose serious difficulties when attempting to reach athletes at high-risk of developing EDs. Given that aesthetics and weight restrictions cannot realistically be expected to shift drastically within a short timeframe, those attempting to reduce the risk of EDs may wish to emphasise the influence that unbalanced dietary practices may have on an athlete's performance and to challenge the myth that a restrictive and/or unhealthy diet is "normal" and associated with the long-term success of an athlete's performance (e.g. Degoutte et al., 2006; Yoshioka et al., 2006).

Third, male athletes have been notably absent from empirical investigations of prevention programmes. Although the prevalence of EDs in athletes is higher in females than males, and elite female athletes are twice as likely to develop an ED as female non-athletes, elite male athletes involved in high-risk sports are 16 times more likely to develop an ED than male non-athletes (Sundgot-Borgen & Torstveit, 2004). Lack of recognition of EDs in male athletes may help account for the lack of prevention programmes targeting this sub-group of athletes; however, the substantially increased risk of EDs in this group warrants the development of prevention programmes aimed at male athletes.

Finally, a general lack of cross-field communication is another barrier slowing progress in the area of ED prevention in high-risk athletes. Prevention programmes for EDs are most often initiated and lead by experts in psychological disorders (i.e. psychologists or psychiatrists); however, prevention programmes attempting to target athletes must collaborate with sport organisations, coaches and experts in sport medicine who may not traditionally be involved in conducting research. In addition, it could prove extremely beneficial to collaborate with current and former elite athletes and coaches when developing ED prevention programmes. When communication between these groups does not occur, empirically supported interventions are not subsequently implemented and disseminated on a larger scale, and conversely, new prevention programmes are implemented without empirically examining their effectiveness.

Future directions. The promising findings for ED prevention programmes in athletes conducted to date suggest that additional research is warranted. First, future research should examine the effectiveness of ED prevention programmes in larger and more diverse samples of athletes, including males, adults and individuals participating in a variety of sports and at different levels of competition (e.g. elite and non-elite). Second, long-term follow-up studies (e.g. 5–10 years post-intervention) should be conducted to examine the maintenance of improvements to DE and the prevalence rates of EDs. Third, it is critical for researchers and clinicians to collaborate with the sport community to ensure that ED prevention programmes meet the needs of athletes and that various stakeholders are invested in ED prevention. To this end, the issues of weight and shape in high-risk sports should be approached with sensitivity and focus on helping athletes better navigate the demands of the sport. If additional research supports the long-term effectiveness of ED prevention programmes in diverse populations of athletes, the ultimate goal should be to implement ED prevention curricula in athletic training institutions in order to lower the risk of DE and EDs in athletes.

Conclusion

Plenty of empirical research suggests that elite athletes involved in lean or weight-based sports are at elevated risk of developing an ED. Although selective prevention programmes have been shown to improve ED risk factors and symptoms in the

general population, prevention programmes and empirical studies targeting high-risk athletes are relatively few in number. Further, the lack of longitudinal studies limits our understanding of the long-term impact of those programmes that have been empirically supported. Hesitation by the sport community to facilitate and participate in research on ED prevention programmes in athletes and poor cross-field communication and collaboration may further hinder progress in the prevention of EDs in athletes. In light of the benefits reported by several ED prevention programmes, future research should focus on resolving the barriers that currently hinder research on ED prevention initiatives for athletes and attempt to reach a broader population of athletes in order to maximise the benefits that involvement in sport can potentially yield.

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