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Article Title: Effects of a Motivational Self-Talk Intervention for Endurance Athletes Completing an Ultramarathon

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Running Head: Effects of self-talk for ultramarathon runners

Abstract

This study examined the effects of strategic, motivational self-talk for runners completing a 60-mile, overnight ultramarathon using a randomised, controlled experiment. Data were collected before, during, and after an annual ultramarathon. Twenty-nine ultramarathon runners were randomly allocated to a motivational self-talk group or an alternative control group. A condition-by-time mixed ANOVA indicated that learning to use motivational self-talk did not affect pre-event self-efficacy or perceived control. A *t*-test and magnitude-based inference indicated that motivational self-talk did not affect performance. Nevertheless, follow-up data suggested that most participants found the intervention helpful and continued to use it six months after their research commitment, particularly in endurance events and to a lesser extent in training. Participants continued to use self-talk to cope with exertion, as well as other stressors such as blister discomfort and adverse conditions. Suggestions are offered for future research examining the effects of psychological interventions on performance in endurance events.

Psychological skills training (PST) can enhance endurance performance. Although self-talk, imagery, goal setting, and packages including multiple PST strategies consistently enhance endurance performance in non-competitive laboratory and field-based endurance tasks, few studies have examined the effects of psychological interventions such as PST on performance in actual endurance events, and these studies showed equivocal intervention effects (McCormick, Meijen, & Marcora, 2015). People typically perform better in endurance tasks when competing (McCormick et al., 2015). Further, athletes need to manage additional stressors, and associated emotions, before and during events (e.g., McCormick, Meijen, & Marcora, 2016; Simpson, Post, Young, & Jensen, 2014), compared to those typically present in experimental conditions. It is therefore important to demonstrate that the performance benefits of PST generalise to actual endurance events. To date, few studies of endurance and other sport performances have measured the effects of a psychological intervention on the competitive performances of athletes using a randomised, controlled experiment (G. L. Martin, Vause, & Schwartzman, 2005). Randomised, controlled experiments are the most rigorous experiments for demonstrating a cause-and-effect relationship between an intervention and an outcome (e.g., Shadish, Cook, & Campbell, 2002). The present study is the first randomised, controlled experiment to examine the effects of PST on performance in an actual endurance event (McCormick et al., 2015). Specifically, this study examined the effect of strategic, motivational self-talk on performance in an ultramarathon.

Self-talk can be defined as what people say to themselves silently in their head or aloud, automatically or strategically, to stimulate, direct, react, and evaluate events and actions (Hatzigeorgiadis, Zourbanos, Latinjak, & Theodorakis, 2014). As captured by this definition, self-talk refers to self-addressed verbalisations or statements that serve a range of functions. These self-addressed verbalisations may occur automatically without being planned or prepared ("inherent self-talk"), or they could be used in a systematic way as a self-regulatory

strategy ("strategic self-talk"). In the sport and exercise psychology literature, there have been two main approaches to researching self-talk (Hatzigeorgiadis, Zourbanos, et al., 2014). An observational approach has particularly focused on inherent self-talk and examined the content of athletes' self-talk (e.g., Van Raalte, Morrey, Cornelius, & Brewer, 2015) and the antecedent or consequent correlates of self-talk (e.g., Hatzigeorgiadis & Biddle, 2008), whereas an experimental approach has examined the effects of strategic instructional or motivational self-talk, particularly on performance (e.g., Hatzigeorgiadis, Galanis, Zourbanos, & Theodorakis, 2014). The present study aligns with this latter approach; it examines the effects of a strategic, motivational self-talk intervention on psychological variables and endurance performance.

Motivational self-talk was chosen as the intervention for three main reasons. First, strategic, motivational self-talk has been shown to enhance endurance performance in randomised, controlled experiments in the laboratory (Blanchfield, Hardy, de Morree, Staiano, & Marcora, 2014; Wallace et al., 2017). Second, self-talk can be fairly straightforward to learn and apply. In the endurance performance literature, learning to strategically use motivational self-talk through a 30-60 minute workbook has led to substantial performance gains (Barwood, Corbett, Wagstaff, McVeigh, & Thelwell, 2015; Blanchfield et al., 2014; Wallace et al., 2017). It could therefore be a time-efficient intervention for a population that often has little free time (Simpson et al., 2014). Third, motivational self-talk is a versatile strategy that could serve multiple functions during an ultramarathon. Specifically, motivational self-talk can help performers to persevere through exertion for longer during endurance performances at a constant workload (Blanchfield et al., 2014; Wallace et al., 2017) and to sustain a faster pace during self-paced performance (Barwood et al., 2015). In addition, motivational self-talk could help ultramarathon runners to cope with the many stressors experienced during actual endurance events. Ultramarathon runners must overcome muscle cramping and injuries, gastrointestinal problems, thoughts about quitting, and adverse weather and conditions, and

they need to carefully pace themselves to meet cut-off times whilst avoiding premature exhaustion (Antonini Philippe, Rochat, Vauthier, & Hauw, 2016; Holt, Lee, Kim, & Klein, 2014; Simpson et al., 2014). As the ultramarathon in the present study was completed overnight, additional event-specific stressors include navigation in the dark and sleep deprivation. Using motivational self-talk as a coping strategy when experiencing stressors could prevent the stressors from eliciting negatively-toned emotions and, consequently, from undermining their motivation to sustain effort and their ability to concentrate on important cues such as navigation cues (e.g., Martinent & Ferrand, 2009).

Five broad experiences characterise involvement in ultramarathon running (Simpson et al., 2014): (a) the support, common personal bonds, and camaraderie of being part of an ultramarathon community; (b) physical (e.g., training, nutrition, hydration), tactical (e.g., preparing equipment and clothing), and mental aspects (e.g., reflecting on previous experiences) of preparing for an ultramarathon; (c) using mental skills to manage performance during a race; (d) having opportunities to push perceived capabilities, to experience nature, and to have spiritual experiences; and (e) the feelings of accomplishment and euphoria experienced after completing an ultramarathon. Although research has shed light on the experiences of ultramarathon runners and the coping strategies ultramarathon runners use (Acevedo, Dzewaltowski, Gill, & Noble, 1992; Antonini Philippe et al., 2016; Holt et al., 2014; Simpson et al., 2014), no published studies have examined the effects of PST on performance in an ultramarathon. Further, no studies have examined the effects of PST on performance in long-distance running events of at least half-marathon distance (McCormick et al., 2015).

In addition to examining the effect of learning and practising motivational self-talk on ultramarathon performance, this study examined whether motivational self-talk increased pre-event self-efficacy and perceived control. When a competition is important to an athlete, when there is uncertainty about the outcome of the competition, and when the competition will

require effort, the athlete may perceive the competition as a challenge or a threat. Whether an athlete approaches the competition as a challenge or a threat depends on whether they evaluate their resources as sufficient to cope with the demands of the competition (Jones, Meijen, McCarthy, & Sheffield, 2009). An athlete is more likely to approach the competition as a challenge if they possess high self-efficacy, perceive having control over the situation, and strive towards achieving goals (Jones et al., 2009). This study examined whether learning motivational self-talk before an ultramarathon could promote a challenge response to the ultramarathon by teaching the athletes a skill, or a resource, that they could use to cope with event demands (e.g., physical and environmental demands, encountered problems) and finish the event (i.e., potentially enhancing their self-efficacy), and by helping the athletes to perceive themselves as having sufficient control over their responses to the event demands (i.e., potentially enhancing their perceived control).

The present study examined the effects of a strategic, motivational self-talk intervention for endurance athletes completing a 60-mile, overnight ultramarathon. There were four aims. The first aim was to examine whether learning and practising motivational self-talk improved performance in an ultramarathon. The second aim was to examine whether learning and practising self-talk increased pre-event self-efficacy and perceived control. The third aim was to determine whether participants were still using self-talk six months after receiving the intervention, as well as the functions of this self-talk, which could indicate whether they found learning self-talk valuable. Studies examining the effects of PST on endurance performance have not reported whether participants continued to use the taught intervention after they finished their commitment to the research (McCormick et al., 2015). The final aim was to highlight psychological aspects of participating in an ultramarathon, such as pre-event and post-event emotions, encountered stressors, and the intensities of perceived effort, exercise-induced muscle pain, and injury pain experienced over the course of an ultramarathon. As well

as helping the reader to understand the nature of this particular ultramarathon, such data could inform future interventions that aim to help ultramarathon runners to cope with the demands of their sport (Simons, 2012).

Methods

Design

A randomised, controlled, posttest-only experimental design was used for the performance dependent variable.[1] For self-efficacy, perceived control, and expectations of performance improvement, pre- and post-intervention comparisons were made. After matching for estimated aerobic fitness, participants were randomly assigned to an experimental group (motivational self-talk) or an alternative control treatment group (concentration grid) by tossing a coin. Alternative control treatments are similar in duration, perceived value, and procedure to the experimental treatment, but they target different outcomes (W. Borg, 1984).

The Ultramarathon

The ultramarathon is an annual 60-mile race along the Thames Path in South England. Participants navigate a flat, rural terrain that passes through villages. The ultramarathon is self-supported; participants carry food, water, and clothing, and they navigate using head torches and supplied route maps. Water and medical attention are available at three checkpoints that are spaced 15 miles apart. Data were collected before, during, and after three ultramarathons (May 2014, May 2015, and June 2016). The ultramarathons began at 8pm, and there were cut-off times for each checkpoint.

Participants

All 148 runners who registered for the ultramarathon on any of the three years were invited to participate. Thirty-two runners (22%) volunteered to participate in the study. Fifteen were randomly assigned to the self-talk group, and 17 were assigned the control group.

Fourteen participants in the self-talk group attended the event and were included in the analyses, and 15 participants in the control group attended the event. Three participants dropped out of the study because they decided not to run the ultramarathon ($n = 2$) or because they had insufficient time for the intervention workbook and did not want to complete rating scales during the ultramarathon ($n = 1$) (a flowchart is available on request). Twenty-five of the 29 participants were male, and 25 were British (M age = 39.3 years, $SD = 8.4$; M height = 177 cm, $SD = 10$; M weight = 73.5 kg, $SD = 8.1$; M weekly training hours = 8.9, $SD = 3.6$; M events of at least half-marathon distance during the previous 12 months = 5.7, $SD = 3.8$; M male estimated $\dot{V}O_{2max}$ = 50.9 ml·kg^{-1}·min^{-1}, $SD = 8.3$; M female estimated $\dot{V}O_{2max}$ = 43.0 ml·kg^{-1}·min^{-1}, $SD = 4.1$). The four non-British participants were fluent in the English language. Achievement goals, in relation to an important endurance event, were measured in Survey 1 using the Achievement Goal Questionnaire for Sport (AGQ-S) (Conroy, Elliot, & Hofer, 2003). Scores on the mastery-approach goals ($M = 17.0$, $SD = 2.99$) subscale were greater than scores on the mastery-avoidance ($M = 11.3$, $SD = 5.57$), outcome-approach ($M = 10.4$, $SD = 4.17$), and outcome-avoidance subscales ($M = 10.3$, $SD = 5.12$) (scores can range from 3 to 21).

Participants had little prior experience with PST, particularly using self-talk systematically. During an intake interview, no participants reported past experience working with a sport psychologist. When describing the mental strategies they use during endurance events, six participants referred to their self-talk statements (two were assigned to the self-talk group and four to the control group), including motivational content. The most common psychological strategy (referred to by 15 participants) was race chunking, which involves breaking the distance down into shorter, more manageable distances.

Procedure

Ethical approval was granted by the department ethics committee, and informed consent was obtained. Figure 1 provides an overview of the timeline, including data collection dates and intervention delivery dates. Self-report data were mainly collected using four online surveys distributed by email. One battery of questionnaires was completed on paper 30-90 minutes before the ultramarathon start. With consideration to missing self-report data, all participants completed Survey 1, 26 participants (90%) completed Survey 2 (two participants in the self-talk group and one in the control group did not), 26 participants (90%) completed all of the pre-event questionnaires (three participants in the self-talk group arrived late), all participants completed Survey 3, and 27 participants (93%) completed Survey 4 (one participant in each group did not). Twenty-three participants (79%) completed all of the surveys. Mean values were calculated using existent data.

Variables

Estimated $\dot{V}O_{2max}$. $\dot{V}O_{2max}$ was estimated using data collected in Survey 1 and corresponding mathematical formulas for males (Malek, Housh, Berger, Coburn, & Beck, 2005) and females (Malek, Housh, Berger, Coburn, & Beck, 2004).

Self-efficacy and perceived control. A self-efficacy scale was designed following the guidance of Bandura (2006). Participants rated how certain they were (0-100 degree of confidence) that they could do each of 10 things during the ultramarathon, which reflected anticipated demands (e.g., "Cope with things going wrong", "Pace yourself effectively", "Cope with the lack of sleep"). "Cannot do at all", "Moderately certain can do", and "Highly certain can do" anchors were placed next to 0, 50, and 100 on the scale, respectively. Participants also rated how much control they perceived their self to have over each of the 10 demands by selecting a number from one ("No control") to 10 ("Complete control"). Overall self-efficacy

and perceived control values were mean values of the 10 ratings. These scales were completed in Survey 1 and at the ultramarathon before the start.

Performance expectations. Expectations of performance improvement were measured pre-randomisation (Survey 1) and before the ultramarathon start to determine the possibility of a placebo effect. Participants rated their degree of agreement with a statement about the potential performance-enhancing effects of psychological interventions on a seven-point Likert scale (1 = "Very strongly disagree", 7 = "Very strongly agree").

Pre-event motivation. Before the ultramarathon start, participants rated their agreement with two statements ("I am motivated to participate in the [ultramarathon name]" and "I am motivated to race against others in the [ultramarathon name]") on a five-point Likert scale (0 = "Not at all", 4 = "Extremely").

Sport emotions. Participants completed the Sport Emotion Questionnaire (Jones, Lane, Bray, Uphill, & Catlin, 2005) before the ultramarathon start, and they retrospectively rated how they felt after they finished the ultramarathon (Survey 4). This questionnaire assesses anger, anxiety, dejection, excitement, and happiness. The fatigue items of the Brunel Mood Scale (Terry, Lane, Lane, & Keohane, 1999) were included among items. Both measures use the same five-point scale, which ranges from 0 ("Not at all") to 4 ("Extremely").

Perception of effort and pain. Nine *research points* were marked on participants' route maps, near to identifiable landmarks. At each, participants were asked to rate their perception of effort, exercise-induced pain, and injury-related pain by marking a value onto a scale. Participants rated their overall perception of effort using the 15-point rating of perceived exertion (RPE) scale (G. A. Borg, 1998), and they rated the intensity of exercise-induced pain and injury-related pain using 0-10 pain scales (Cook, O'Connor, Eubanks, Smith, & Lee, 1997). Perception of effort was defined as how effortful, heavy, and strenuous the exercise feels. Exercised-induced pain was defined as the pain that is produced by muscle burn and ache

as a result of repeated or prolonged muscular contraction, whereas injury-related pain was defined as the pain that may result from injury (e.g. blisters, twisted ankle). Sixteen participants (55%) recorded all RPE and pain values applicable to them, and an additional four participants (14%) recorded most RPE and pain values.

Performance. Event officials recorded each participant's finishing time to the nearest minute. Performance times were downloaded from the official website of the ultramarathon.

Manipulation checks. Following the ultramarathon (Survey 3), questions determined whether participants in the self-talk group used the workbook to identify self-talk statements (Yes/No), to what extent these participants used self-talk statements during the ultramarathon (five-point Likert scale), whether self-talk statements were helpful (Yes/No), and the occasions and purposes of using self-talk statements (qualitative data). Participants in the concentration-grid group used the same five-point Likert scale (1 = "Never", 5 = "A great deal") to report the extent to which they used self-talk statements during the event.

Contamination checks. Following the ultramarathon (Survey 3), contamination questions were used to determine whether participants were aware of the other intervention.

Social validity. Social validation is used to determine satisfaction with an intervention (Page & Thelwell, 2013). Following the ultramarathon (Survey 3), participants used a five-point Likert scale to rate the extent to which an improvement in long-distance running performance is important to them, the extent to which an improvement in concentration is important to them (control group only), the extent to which the intervention-delivery methods were acceptable, the extent to which they viewed changes in their long-distance running performance to be significant, and the extent to which they viewed changes in their concentration to be significant (control group only) (1 = "Strongly disagree", 5 = "Strongly agree"). Six months after the ultramarathon (Survey 4), participants re-rated the extent to which they viewed changes in their performance and concentration to be significant.

Follow-up of intervention use. Six months after the event, participants reported whether they were still using self-talk statements (self-talk group) or concentration grids (control group) using a five-point Likert scale (1 = "Not at all", 5 = "A great deal"). Participants in the self-talk group were asked whether they used self-talk statements in training during the previous month and during their most recent long-distance running event. They also provided information on the occasions and purposes of using self-talk statements.

Interventions

Intake interview. An intake interview was conducted with each participant to build rapport before distributing the intervention workbooks and to gain information relevant to the study. The primary researcher ran 20 intake interviews by video call and nine by telephone. Using a set protocol, the researcher and participant discussed the following topics: the participant's involvement in distance running and the ultramarathon; the participant's expectations and goals for the ultramarathon; what sport psychology is and the participant's experiences with it; psychological strategies already used by participants; and the format of the workbook. Participants were asked not to discuss the content of their workbook with other competitors, including competitors in later years. The mean intake duration was 39 minutes ($SD = 16$).

Workbooks. To the extent possible, the workbooks were presented in a similar format. Both workbooks included educational material, exercises for participants to complete, and four practice logs that would each take up to five minutes to complete. The workbooks were distributed one day after the final intake interview.

Self-talk workbook. Learning to strategically use motivational self-talk through a 30-minute workbook, followed by two weeks of practising self-talk during exercise bouts and refining self-talk statements, has been shown to benefit endurance performance (Blanchfield et

al., 2014). Following a brief introduction to self-talk statements, participants were asked to notice their self-talk during a training run, and they recorded the effects that self-talk statements had on how they felt. Participants then compared their statements to 32 motivational statements that were located in the self-talk literature (Blanchfield et al., 2014; Miller & Donohue, 2003) or PST consultancy notes, and they picked four statements from the two lists that would be valuable during the beginning, middle, or later stages of the ultramarathon (Blanchfield et al., 2014). Participants were encouraged to use motivational statements to counter thoughts about withdrawing effort and in response to "critical moments" such as hitting the wall, getting lost, and falling behind targets. Participants were encouraged to practise and refine statements in training until the ultramarathon. Participants were asked to complete four logs detailing their use of self-talk (Blanchfield et al., 2014).

Concentration workbook. The importance of concentration in sport was briefly introduced. The workbook then introduced the concentration grid and explained how participants could use it to develop their concentration. Participants were encouraged to complete at least two concentration grids each day, on as many days as possible, until the ultramarathon, and they were asked to practise in both quiet and distracting environments. Participants were given 20 concentration grids, and they were asked to complete four logs detailing their use of the concentration grid.

Compliance checks. Participants completed a survey before the ultramarathon (Survey 2) to determine whether they had read the workbook and were practising their allocated strategy. Participants were given the opportunity to ask questions. Answers to questions were sent by email to all participants using the same workbook.

Data Analysis

A one-tailed, independent-samples *t*-test was used to determine if there was a statistically-significant difference in the performance times between groups. To address the practical significance of the effect on performance—particularly considering the small sample size and posttest-only design—the probabilities that the true effect size is beneficial (Cohen's *d* > 0.20), trivial (between ± 0.20), or harmful (< -0.20) were calculated using a magnitude-based inferences spreadsheet (http://sportsci.org/resource/stats/generalize.html) (Batterham & Hopkins, 2006). Condition-by-time (2x2) mixed ANOVAs were used to determine whether the intervention influenced changes in self-efficacy and perceived control. Partial eta squared (η_p^2) effect sizes are presented for these ANOVAs (small, moderate, and large effect size anchors are 0.01, 0.06, and 0.14, respectively). Mann-Whitney U tests were used to compare pre-post changes in expectations of performance improvement and pre-event motivation values between groups. Qualitative data from Survey 3 and Survey 4 were organised into themes.

Results

Self-Efficacy

For participants in the self-talk group, self-efficacy decreased from a mean of 88.7 (*SD* = 7.44) when Survey 1 was completed (pre-randomisation) to 83.5 (*SD* = 9.85) (out of 100) at the ultramarathon before the start. For participants in the control group, self-efficacy increased from 86.9 (*SD* = 10.2) to 87.5 (*SD* = 9.41). The main effect of time, $F(1, 24) = 1.74$, $p = .20$, $\eta_p^2 = 0.068$, the main effect of condition, $F(1, 24) = 0.12$, $p = .73$, $\eta_p^2 = 0.005$, and the interaction between time and condition, $F(1, 24) = 2.70$, $p = .11$, $\eta_p^2 = 0.10$, were not statistically significant.

Perceived Control

For participants in the self-talk group, perceived control decreased from a mean of 8.46 (SD = 0.95) when Survey 1 was completed to 7.89 (SD = 1.62) (out of 10) at the event before the start. For participants in the control group, perceived control decreased from 8.73 (SD = 1.31) to 8.33 (SD = 1.12). The main effect of time was statistically significant, $F(1, 24) = 5.34$, $p = .030$, $\eta_p^2 = 0.18$. The main effect of condition, $F(1, 24) = 0.60$, $p = .45$, $\eta_p^2 = 0.024$, and the interaction between time and condition, $F(1, 24) = 0.15$, $p = .70$, $\eta_p^2 = 0.006$, were not statistically significant.

Performance Expectations

Expectations of performance improvement immediately before the ultramarathon were slightly higher in the self-talk group (out of 1 to 7, median [Mdn] = 5.5, interquartile range [IQR] = 5 to 6) than the control group (Mdn = "5 – Agree", IQR = 4 to 5). Changes in expectations of performance improvement, from pre- to post-intervention, did not differ significantly between groups (both $Mdns$ = 0, self-talk IQR = -1 to 0.5, control IQR = -1 to 0), $U = 60.0$, $p = .15$.

Pre-Event Motivation

Motivation to participate did not differ significantly between groups (out of 0 to 4, both $Mdns$ = "3 – Very much", self-talk IQR = 3 to 3.5, control IQR = 3 to 4), $U = 77.5$, $p = .55$. Motivation to race against others also did not differ significantly (self-talk Mdn = "2 – Somewhat", self-talk IQR = 1 to 2.5, control Mdn = "1 – A little bit", control IQR = 1 to 2), $U = 74.5$, $p = 0.46$.

Sport Emotions

Emotions and fatigue data are presented in Table 1. Participants generally felt happy and excited before the ultramarathon and after finishing it, with some pre-start anxiety and post-event fatigue.

Ultramarathon Characteristics

Ten participants (34%) ran with other runners throughout the ultramarathon. The 19 participants who performed alone estimated that they ran alone for a mean of 49% ($SD = 36$) of the ultramarathon (i.e., time alone varied greatly between participants). As preparation for a 184-mile ultramarathon along the route, 11 participants (38%) (six self-talk, five control) carried some additional equipment with them, and three participants (10%) (one self-talk, two control) carried all additional equipment with them (e.g., sleeping and cooking equipment). Mean estimated equipment weights for these participants were 5.6 kg ($SD = 1.1$) (four self-talk participants provided estimates of $M = 5.3$ kg, $SD = 1.3$, and six control participants provided estimates of $M = 5.8$ kg, $SD = 1.1$). As displayed in Figure 2, RPE, exercise-induced pain, and injury-related pain increased with distance covered during the ultramarathon.[2] Twenty-two of 29 (76%) of all entrants (83% of finishers) experienced new or pre-existing injuries, including blisters, during the ultramarathon. Excluding injury, 24 of 29 participants (83%) (11 of 14 self-talk, 13 of 15 control) encountered problems during the ultramarathon. By far, the most common problem, reported by 16 participants (55%) (six of 14 self-talk, 10 of 15 control), related to difficulty navigating in the dark and associated navigation errors.

Performance

Eleven of 14 participants in the self-talk group finished the ultramarathon, and 13 of 15 participants in the control group finished. A statistician, who viewed performance times but was blinded to allocations, suggested only including participants who met the advertised time

limit of 15 hours (20 of 24 finishers) in the analyses. The mean performance time of the self-talk group (824 minutes, $SD = 97$) was 12 minutes (1.44%) faster than the control group (836 minutes, $SD = 75$), $t(18) = 0.31$, $p = .76$. The effect size was trivial (Cohen's $d = 0.13$). The probability that the true effect is practically harmful/trivial/beneficial is 22.1/34.6/43.3%. For transparency, analyses with all finishers included are also presented. The mean time of the control group (848 minutes, $SD = 75$) was five minutes (0.57%) faster than the self-talk group (853 minutes, $SD = 114$), $t(22) = 0.13$, $p = .90$. The effect size was trivial (Cohen's $d = -0.05$). The probability that the true effect is practically harmful/trivial/beneficial is 35.6/37.4/27.0%. The efficacy of self-talk was unclear in both analyses.

Intervention Compliance

Twelve of 14 participants in the self-talk group reported that they used the workbook to identify self-talk statements, and 10 participants submitted completed workbook logs. When participants used a five-point (1-5) Likert scale to indicate if they used self-talk during the ultramarathon, the median response for participants in the self-talk group was "3 – Occasionally" ($IQR = 3$ to 5, no participants reported no self-talk use), and the median response for participants in the control group was "1 – Never" ($IQR = 1$ to 3, eight participants reported no self-talk use). Twelve of 15 participants in the control group reported that they had completed concentration grids, and 10 participants submitted completed workbook logs.

Intervention Contamination

No participants reported being told about the content of the other workbook.

Social Validity

Improvements in long-distance running performance were important to both groups (out of 1 to 5, self-talk $Mdn =$ "4 – Agree", $IQR = 4$ to 5, control $Mdn =$ "5 – Strongly agree", $IQR = 4$ to 5), improvements in concentration were important to the control group ($Mdn = 4$,

IQR = 4 to 5), and the methods used to deliver the interventions were acceptable to participants in both groups (both *Mdns* = 4, self-talk *IQR* = 4 to 5, control *IQR* = 3 to 5). After the ultramarathon, changes in performance were not considered to be significant by either group (both *Mdns* = "3 – Neither agree or disagree", self-talk *IQR* = 2.5 to 4, control *IQR* = 3 to 3), and changes in concentration were not considered to be significant by the control group (*Mdn* = 3, *IQR* = 3 to 4). Eleven of 14 participants in the self-talk group reported that using self-talk statements was helpful during the ultramarathon. Six months after the ultramarathon, changes in running performance were considered significant by the self-talk group (*Mdn* = 4, *IQR* = 3 to 4). More participants (8 of 13 respondents) perceived that self-talk had benefited their performance six months after the ultramarathon, compared with soon after the ultramarathon (5 of 14 respondents). Changes in performance and concentration were not considered significant by the control group (*Mdns* = 3, *IQRs* = 1 to 4).

Follow-Up of Intervention Use

Six months after the ultramarathon, 11 of 13 participants in the self-talk group reported intentionally using self-talk in training during the previous month (out of 1 to 5, *Mdn* = "3 – Occasionally", *IQR* = 2 to 3). Ten of 11 participants who had participated in a long-distance running event since the ultramarathon reported intentionally using self-talk during their most recent event (*Mdn* = "4 – A moderate amount", *IQR* = 3 to 4), which was a mean of 21 weeks (*SD* = 7) after the ultramarathon. Three of 11 participants in the control group reported using the concentration grid during the previous month.

Qualitative Data

Participants in the self-talk group reported finding self-talk particularly helpful during the ultramarathon for different reasons. Reasons reported were: to focus (e.g., on the goal of completion) (reported by four); to cope with feelings of tiredness (reported by three), pain

(reported by one), and injury (reported by one); and to cope with other stressors, namely getting lost or going off course (reported by two), low moments (reported by one), and adverse weather (reported by one). Six months after the ultramarathon, the most common use of self-talk in training (reported by nine) was to persevere or to push harder, particularly despite tiredness (specifically referred to by six) (e.g., "[I used self-talk] as I felt tired and unwilling to run, or to make me do a hard effort faster"). The most common uses of self-talk in events were to persevere or to push harder (reported by five) and to cope with tough periods of the race (reported by four) that included the following stressors: blisters (reported by two); navigation errors (reported by one); low moments (reported by one); feeling wet and cold (reported by one); and adverse weather (reported by one). Comments of seven participants in the self-talk group indicated that that they had, to some extent, been using self-talk statements naturally or unsystematically before commencing the study.

Discussion

This research examined the effects of a strategic, motivational self-talk intervention for endurance athletes completing a 60-mile, overnight ultramarathon. Laboratory research demonstrates that motivational self-talk can improve endurance performance, but no randomised, controlled experiments have examined the effects of self-talk (or other PST interventions) at actual events. The results did not demonstrate a performance benefit. The sample size was small, however, and performance times varied considerably because of variations in competitive standard, injury, and navigation errors. These factors reduce statistical power compared to well-controlled laboratory settings and shorter-duration endurance tasks. Participants also spent much of the race running with others, meaning that they may not have chosen their own pace.

Although a performance benefit was not demonstrated, the data suggested that most participants found the intervention helpful and continued to use it six months after their commitment to the research, particularly in endurance events and to a lesser extent in training. Participants continued to use self-talk to cope with exertion, as well as other stressors such as blister discomfort and adverse conditions. Further, an additional three participants perceived that self-talk had benefited their performance six months after the ultramarathon, compared with soon after the ultramarathon. These findings highlight the potential value of self-talk to endurance athletes, because the study did not require the athletes to continue using self-talk.

Many endurance athletes naturally talk to themselves during endurance events. For example, Van Raalte, Morrey, Cornelius, and Brewer (2015) found that 88% of marathon runners engaged in various types of self-talk that included motivational, associative, dissociative, goal-related, incentive, mantra, and spiritual self-talk. In the present study, the intake interviews and the data of the control group suggested that, without receiving the self-talk workbook, participants were mostly unaware of using self-talk. During the intake interview, only six of 29 participants referred to using self-talk statements as a psychological strategy during long-distance running events, and eight of 14 participants in the control group reported using no self-talk (of any type) during the ultramarathon. The self-talk group used self-talk more often during the ultramarathon than the control group and, after using the workbook, seven participants in the self-talk group commented that they previously used self-talk naturally or unsystematically. It is proposed that the workbook used in this study helped athletes to become aware of their self-talk and its consequences, and encouraged them to use self-talk more often, and also more systematically.

This study also examined whether learning and practising self-talk increased pre-event self-efficacy and perceived control. Self-efficacy, perceptions of control, and striving towards achieving goals influence challenge responses to upcoming competition (Jones et al., 2009).

Participants in the present study strived to achieve mastery goals, which means that they typically strived to achieve absolute or intrapersonal competence (Conroy et al., 2003). In other words, participants strived to perform well relative to their own standards, rather than relative to others. This finding is consistent with research that demonstrates that many ultramarathon runners attempt to achieve personal goals such as finishing or achieving a time, instead of placement goals (Acevedo et al., 1992; Simpson et al., 2014). In addition to striving for mastery goals, participants in the present study reported high self-efficacy and perceived control, independent of whether they were in the experimental or control group. These findings suggest that participants in this study typically experienced a challenge response, rather than a threat response, to the upcoming ultramarathon. This challenge response was accompanied by positively-toned emotions (cf. Jones et al., 2009); emotional states before the start were characterised by excitement, happiness, and some anxiety. Self-efficacy and perceived control values indicated that participants believed that they could cope with event demands and finish the event (i.e., high self-efficacy) and that they perceived themselves as having sufficient control over their responses to the event demands (i.e., high perceived control). The self-talk intervention did not enhance these perceptions.

The presented data highlight the demands facing ultramarathon runners. Specifically, the ultramarathon runners experienced increasing intensities of perceived effort, exercise-induced pain (aching and burning muscles), and injury-related pain during the ultramarathon. During actual endurance events such as the ultramarathon, endurance athletes also need to cope with a plethora of additional stressors. These stressors include gastrointestinal problems, thoughts about quitting, and adverse weather and conditions (Antonini Philippe et al., 2016; Holt et al., 2014). In the present study, navigating in the dark was a key stressor experienced by runners. These additional stressors are rarely experienced by participants performing in sport science laboratories and non-competitive field settings, which is where the majority of

research on psychological interventions for endurance performance has been conducted (McCormick et al., 2015). It is important that endurance athletes can cope with these stressors, as they could elicit a potentially debilitative emotional response (e.g., Martinent & Ferrand, 2009) and increase the demands of the situation compared to non-competitive environments.

Future Research Suggestions

Although research examining the effects of psychological interventions at actual endurance events is encouraged, this study highlights methodological challenges associated with collecting data at an endurance event. Performance times in events such as the ultramarathon may not compare to participants' performance times in other events, because of differences in distance and race profile, and unique features of events. Randomised, controlled, posttest-only designs may therefore be an appropriate choice of design, but these designs require high participant numbers for statistical power, which may not be achievable. Future experimental research at actual endurance events could use posttest-only designs to examine performance in mass-participation events that involve thousands of entrants, or use randomised, controlled, pretest-posttest designs—which have higher statistical power—to examine performance in events that have less within-subject variability in performance times between events. Such research is encouraged because of the plethora of additional stressors, and associated emotions, experienced in actual events.

Participants assigned to the control group were given an alternative control treatment. Providing control participants with an alternative treatment was intended to discourage them from seeking the self-talk workbook (i.e., contamination), which could have reduced the observed effect of the self-talk intervention. Further, similar intervention demands were placed on control participants as the experimental group (e.g., time demands, completion of logs as evidence of compliance), which can reduce bias associated with study dropouts (W. Borg,

1984). The alternative control treatment involved practising concentration grids to develop concentration. It is questionable, however, whether this control intervention had similar perceived value to the self-talk intervention. Although participants in the control group reported that improvements in concentration were important to them, only three of 14 participants in the control group were still using the concentration grid at the six-month follow-up. In contrast, 12 of 14 participants in the self-talk group reported still using self-talk. The self-talk group might therefore have valued the content of their workbook more. Further, experimental research suggests that the concentration grid might not be efficacious at improving concentration when it is used in isolation, rather than as part of a PST package, without extensive practice (Greenlees, Thelwell, & Holder, 2006). Finally, although the alternative control treatment targeted concentration rather than performance, an improvement in concentration could potentially improve ultramarathon performance; that is, the targeted outcomes are somewhat related (cf. W. Borg, 1984). When designing the concentration workbook, care was therefore taken not to suggest performance-relevant cues that participants could apply the concentration grid to during the ultramarathon; omitting this information might have detrimentally affected the perceived value of the alternative control treatment. Although using the concentration workbook as an alternative control treatment has limitations, no participants in the control group reported being aware of the content of the self-talk intervention. This suggests that the alternative control treatment prevented contamination and therefore served a valuable purpose. Researchers conducting psychological intervention research are encouraged to consider different ways of including an alternative control treatment, to reduce sources of bias that could influence conclusions.

Limitations

Intake interviews were conducted before participants were allocated to experimental and control groups. Once participants had received their workbook, the researcher did not speak with participants about their particular workbook by video call or telephone. Instead, participants were able to ask questions using a survey, and these questions were answered by email. These decisions were made to prevent biasing the results by systematically introducing expectation effects. This intervention format, however, is unrepresentative of how self-talk interventions are delivered in applied settings (e.g., Latinjak, Font-Lladó, Zourbanos, & Hatzigeorgiadis, 2016). Additional personalised support from a sport psychologist could have encouraged even greater compliance, refined participants' use of self-talk, and ultimately increased the size of the intervention effect.

With consideration to external validity, participants in the study were those ultramarathon entrants who volunteered for the research (22% of all entrants), rather than a random selection of all entrants (cf. Bracht & Glass, 1968). The participants included in the study may not therefore be representative of ultramarathon runners as a population. For example, they may have had less competing time commitments, allowing them to meet the time demands of the research. They may also have different attitudes towards sport psychology. For example, they may have been less influenced by stigmas associated with working with a sport psychologist, they may have had greater confidence in sport psychology consultants, or they have had been more open to working with a sport psychologist (S. B. Martin, Bochum, Lavallee, & Page, 2002). As a consequence, participants may have perceived the intervention differently and been more likely to comply with the intervention. Nevertheless, people who are willing and able to participate in studies could be more representative of sport psychology consumers if common characteristics, such as time availability and attitudes towards sport

psychology, determine whether endurance athletes volunteer for studies and pursue psychological assistance.

Conclusion

This study provides unique data on psychological intervention effects at an actual endurance event, using a strong experimental design. The results showed that learning to use strategic, motivational self-talk did not affect pre-event self-efficacy or perceived control. It also did not affect performance in the ultramarathon, although this latter finding could be explained by the sample size and variability in performance times. Nevertheless, the data suggested that most participants found the intervention helpful and continued to use it six months after their commitment to the research, particularly in endurance events and to a lesser extent in training. Participants continued to use self-talk to cope with exertion, as well as other stressors. Additional research examining the effects of psychological interventions on performance in actual endurance events, where a plethora of stressors and associated emotions are experienced, is encouraged.

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Notes

[1] Additional detail on the methods is available (McCormick, 2016).

[2] All event competitors carried GPS tags that gave real-time information on their progress. These GPS tags provided information on each participant's pacing. GPS data were only available for the second year. There was insufficient GPS and self-report data to compare ratings of perceived exertion and pain, relative to pace, between conditions.

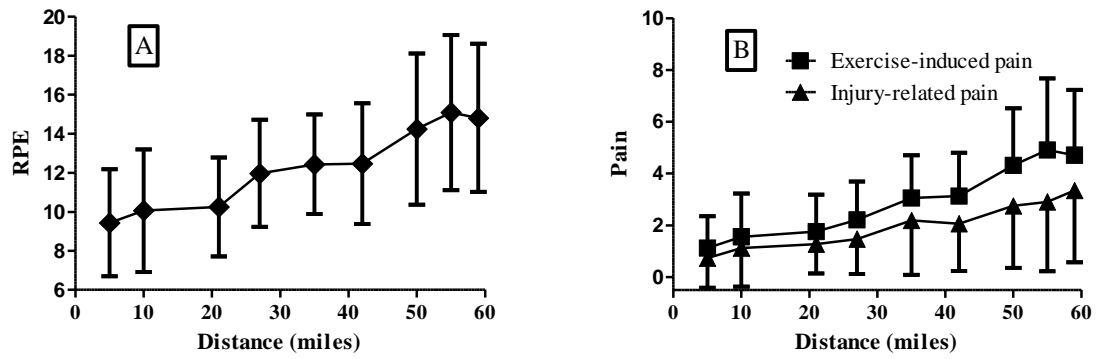**Figure 1.** Overview of the study timeline.

Figure 2. Mean and standard deviation ratings of perceived exertion (RPE) (panel A) and ratings of pain (panel B) during the ultramarathon.

Table 1: Sport Emotions and Fatigue Before the Ultramarathon and After Completing the Ultramarathon.

	Pre-event	Post-event
Anxiety	$M = 1.50$, $SD = 0.92$	$M = 0.067$, $SD = 0.13$
Dejection	$M = 0.13$, $SD = 0.37$	$M = 0.29$, $SD = 0.53$
Excitement	$M = 2.52$, $SD = 0.82$	$M = 2.25$, $SD = 1.01$
Anger	$M = 0.056$, $SD = 0.20$	$M = 0.17$, $SD = 0.27$
Happiness	$M = 2.39$, $SD = 0.98$	$M = 2.96$, $SD = 0.93$
Fatigue	$M = 0.66$, $SD = 0.59$	$M = 2.25$, $SD = 0.94$

Note. Anxiety, dejection, excitement, anger, and happiness were measured using the Sport Emotion Questionnaire (Jones, Lane, Bray, Uphill, & Catlin, 2005). Fatigue was measured using the Brunel Mood Scale (Terry, Lane, Lane, & Keohane, 1999). Post-event values were reported retrospectively, a mean of 4 days ($SD = 6$) after completing the event. Scores can range from 0 to 4.