

TITLE

The sources of self-efficacy in experienced and competitive endurance athletes

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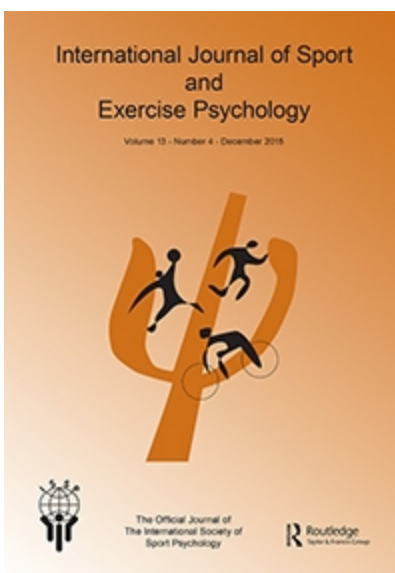
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The Sources of Self-Efficacy in Experienced Competitive Endurance Athletes

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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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Abstract

Endurance athletes draw on several sources of self-efficacy, but there is a limited understanding of what information within these sources specifically contributes towards self-efficacy. An increased understanding and awareness of the sources of self-efficacy for endurance performance would allow the design and delivery of more effective self-efficacy interventions. The aim of the current study was to identify sources of self-efficacy specific to the endurance sport domain. Semi-structured interviews were conducted with twelve experienced competitive endurance athletes who had been competing in their endurance sport for an average of 12.2 ± 6.25 years. Interviews were recorded, transcribed verbatim, and analysed using deductive thematic analysis. Past performance experiences, physiological states, social/verbal persuasions and emotional states were generated as initial themes. Within these themes, six sub-themes were identified: cumulative experiences, challenge and adversity, physical familiarity, social support, self-talk, and doubt and worry. Our results indicate that endurance athletes make use of several sources of self-efficacy in the formation and maintenance of their self-efficacy beliefs. Specifically, the culmination of experiences, experiences of overcoming challenge and adversity, and a sense of physical familiarity appeared to key sources in the endurance sport domain.

Keywords: endurance sports; **social-cognitive**; qualitative

Word count: 7786 (excl. references)

SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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23 The Sources of Self-Efficacy in Experienced Competitive Endurance Athletes

24 Endurance sports are characterised by continuous, dynamic, and whole body exercise tasks
25 (McCormick, Meijen, & Marcora, 2015), often seen in the form of running, swimming, or cycling.
26 Despite differences in the mode of movement, endurance sport performance is often underpinned
27 by similar physiological and psychological determinants (Joyner & Coyle, 2008; McCormick,
28 Meijen, & Marcora, 2015). One psychological determinant identified by McCormick et al. (2015)
29 was self-efficacy, which exists within the broader remit of social-cognitive theory.

30 **Social-Cognitive Theory and Self-Efficacy**

31 In social-cognitive theory human functioning is governed by a process of triadic reciprocal
32 determinism that exists between an individual's personal events, their behaviour, and their
33 environment (Bandura, 1997). Central to this process, is the understanding that individuals have
34 the capability for control over their own thoughts, emotions and behaviours. **This capability for
35 control occurs through the possession of a variety of socio-cognitive mechanisms such as
36 symbolisation and vicarious modelling (Bandura, 1997). Symbolisation allows individuals to
37 assign weight and meaning to events and create internal models of experience (e.g. their view of
38 themselves and their own capabilities), whereas vicarious modelling occurs through the
39 observation of other individual's actions and consequences.** Through these mechanisms'
40 individuals develop a series of beliefs about themselves and the world around them. Of these
41 beliefs, self-efficacy is argued to be one of the key factors in understanding human functioning
42 (Bandura, 1997).

SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 43 Self-efficacy refers to the “belief in one’s capabilities to organize and execute the courses
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5 44 of action required to produce given attainments” (Bandura, 1997, p.3). It represents an individual’s
6
7 45 belief as to what they are capable of doing, such as a runner believing they are capable of
8
9 46 completing a marathon in a particular time. When an individual possess a strong sense of self-
10
11 47 efficacy they are likely to set themselves more challenging goals in relation to the task (Bandura
12
13 48 & Locke, 2003), invest more effort into the task (Tenenbaum & Hutchinson, 2012), and display
14
15 49 higher levels of perseverance when faced with obstacles and difficulties (Feltz, Short, & Sullivan,
16
17 50 2008). Although it has been suggested that that high levels of self-efficacy in certain situations
18
19 51 may have null, or negative effects on performance (e.g. Halper & Vancouver, 2016) the majority
20
21 52 of research has continually linked with self-efficacy with superior performance in sport and
22
23 53 exercise settings (Feltz et al., 2008; Moritz, Feltz, Fahrback, & Mack, 2000; McAuley & Blissmer,
24
25 54 2000).

55 Self-Efficacy and Endurance Performance

56 The relationship between self-efficacy and performance is also evident in the endurance sport
57 domain. A positive relationship between self-efficacy and performance in a variety of endurance
58 sports including Ironman triathlon (Burke & Jin, 1996), distance running (Bueno, Weinberg,
59 Fernández-Castro, & Capdevila, 2008; Martin & Gill, 1991), and swimming (Miller, 1993) has
60 been consistently observed. Self-efficacy may lead to improvements in endurance sport
61 performance because of two mechanisms: pain tolerance and perception of effort. The ability to
62 tolerate high levels of exercise induced pain has been suggested to be an important determinant of
63 endurance performance (Astokorki & Mauger, 2016; Mauger, 2014), and self-efficacy has been
64 associated with improvements in pain tolerance (Bandura, 1997; Johnson et al., 2012). Self-
65 efficacy can improve pain tolerance as it encourages the engagement of more adaptive coping

SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 66 mechanisms, and also ensures an individual's engagement for longer periods of time (Peerdeman,
4
5 67 van Laarhoven, Peters, & Evers, 2016). Self-efficacy is also associated with reductions in
6
7 68 perception of effort (Hutchinson et al., 2008; Robbins, Pender, Ronis, Kazanis, & Pis, 2004), and
8
9 69 perception of effort is another important determinant of endurance performance (Marcora, 2009;
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11 70 McCormick et al., 2015).

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15 71 Given the positive relationship between self-efficacy and endurance performance, and the
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17 72 evidence for potential mechanisms explaining this relationship, the possession of robust and
18
19 73 accurate self-efficacy beliefs is likely to be a desired outcome in endurance athletes. In order to
20
21 74 achieve this, it is important to understand how self-efficacy beliefs are formed, maintained and
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23 75 altered.

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27 76 **The Sources of Self-Efficacy**

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29
30 77 Self-efficacy beliefs are generated through a series of cognitive processes involving the selection,
31
32 78 interpretation, and integration of several sources of information (Bandura, 1997; Maddux, 1995).
33
34 79 An individual's experiences and success are hypothesised to be the most powerful source of self-
35
36 80 efficacy information (Bandura, 1997). If these past experiences are perceived to have been
37
38 81 successes, this will result in an increase in self-efficacy, whereas if past experiences are perceived
39
40 82 to have been failures, this will undermine self-efficacy. Factors such as task difficulty, external
41
42 83 support, and occurrences of failure can all contribute to the efficacy value assigned to a past
43
44 84 performance (Bandura, 1997). Past performance experiences have been consistently demonstrated
45
46 85 to be one of the most cited sources of self-efficacy in sporting settings (Chase, Feltz, & Lirgg,
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48 86 2003; Samson, 2014).
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 87 Vicarious influences are another source of self-efficacy information, and these are based
4
5 88 around learning and modelling from others. Watching someone persevere with a difficult task can
6
7 89 help develop self-efficacy towards this task, if the observer feels the person they are watching, the
8
9 90 modeller, is similar to them (i.e. sex, skill level, age) (Bandura, 1997). This can have implications
10
11 91 relating to pacing in endurance events, where individuals may choose to make decisions based on
12
13 92 how others around them are performing (Corbett, Barwood, Ouzounoglou, Thelwell, & Dicks,
14
15 93 2012).

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20 94 Social and verbal persuasions act as a third source of self-efficacy. These can represent
21
22 95 feedback and support from coaches and training partners, expectations from others, and self-talk.
23
24 96 Regarding the appraisal of verbal persuasion as a source, the expertise and credibility of the
25
26 97 provider, the framing of the performance feedback and the degree of disparity between what is
27
28 98 said and the individuals own beliefs regarding their capabilities are all influential factors (Bandura,
29
30 99 1997; Stoate, Wulf, & Lewthwaite, 2012).

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34 100 **Physiological states are a further source of self-efficacy**, and refer to feelings of strength,
35
36 101 arousal, pain, fitness, and fatigue that are cognitively appraised by individuals in order to ascertain
37
38 102 their ability to successfully meet the task at hand. Bandura (1997) hypothesised that the more
39
40 103 physically demanding a task, the greater the contribution towards self-efficacy that physiological
41
42 104 states would make. This hypothesis has received some support as distance runners preparing for a
43
44 105 marathon cited physiological states most often (Samson, 2014), and physiological states have been
45
46 106 less cited as sources of self-efficacy in less physically demanding sports such as golf (Valiante &
47
48 107 Morris, 2013).

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53 108 The last proposed source of self-efficacy relates to an individual's perceptions of their
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55 109 emotional states. Similarly to physiological states, individuals appraise and interpret their
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 110 emotional state and they consider how this relates to their experiences. Self-efficacy beliefs are
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5 111 often enhanced through positive emotions and decreased through negative emotional states (Martin
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7 112 & Gill, 2002). In an endurance context, the experience of positive emotions, such as feelings of
8
9 113 happiness and calmness have been linked with increased levels of self-efficacy in road wheelchair
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11 114 racing (Martin, 2002).
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15 115 Alongside these sources of self-efficacy, it is also necessary to consider research which has
16
17 116 examined sources of sport-confidence. The sport-confidence model was proposed by Vealey
18
19 117 (1986), in response to the need for sport specific models of self-confidence. Sport-confidence
20
21 118 differs from self-efficacy in that it represents a more general sense of confidence (e.g. I am a
22
23 119 confident athlete) as opposed to being related to a specific task (e.g. I am confident in my ability
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25 120 to do well in this race). Vealey et al. (1998), through a series of studies with high school and
26
27 121 collegiate athletes, identified nine sources of sport-confidence. Similarly, Hays et al. (2007) also
28
29 122 identified nine sources of sport-confidence in ‘World Class’ athletes. Several of the sources
30
31 123 identified by Vealey and Hays demonstrate an overlap with Bandura’s sources of self-efficacy,
32
33 124 most likely because self-efficacy was used as the basis for sport-confidence. For instance,
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35 125 “coaches’ leadership”, “social support”, and “coaching” all can be considered part of the social
36
37 126 and verbal persuasions source (Feltz et al., 2008). Several of the sources identified, however, did
38
39 127 not appear to fit into any of the proposed sources. For instance, Hays et al. (2007) identified a
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41 128 source of “innate ability” which referred to an athlete’s belief that they had been born with certain
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43 129 positive characteristic that benefitted them in their sport. Whereas such a finding may at first
44
45 130 appear to indicate the existence of further sources not identified by Bandura (1997), what it instead
46
47 131 may represent is an example of the appraisal and attributional processes which accompany the
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49 132 formation of self-efficacy beliefs. The belief in “innate ability” may be a way for athletes to
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 133 attribute their performances to internal, stable, and uncontrollable causes, which has been
4
5 134 previously demonstrated to lead to increases in self-efficacy (Gernigon & Delloye, 2003). These
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8 135 findings help demonstrate the need to not only understand *what* information contributes to self-
9
10 136 efficacy beliefs, but also *why* and *how* this information may contribute.

13 137 Although there are likely to be similarities in the sources of self-efficacy across the sporting
14
15 138 domain, such as the importance of training, coaching, and previous winning experience, there is
16
17 139 also likely to be substantial variation in both the salience of the sources, and the information within
18
19
20 140 these sources that contribute to self-efficacy (Feltz et al., 2008). For instance, the source of
21
22 141 “physiological states” may have increased salience for more physically demanding sports such as
23
24 142 distance running, compared to less physically demanding sports such as archery. The only study
25
26
27 143 to date to examine the sources of self-efficacy in an endurance sport context is by Samson (2014),
28
29 144 who investigated the sources of self-efficacy in a group of distance runners who were engaging in
30
31 145 a training program for an upcoming marathon. Physiological states, verbal and social persuasions,
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33
34 146 and past performance experiences were the three most frequently cited sources of self-efficacy for
35
36 147 the athletes. Whereas the study helped to identify the salience of the different sources and provided
37
38 148 further evidence that athletes draw on a range of sources, it did not identify what information
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41 149 within these sources contributes towards self-efficacy, and also how and why this may occur.
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43 150 Identification of the sources of self-efficacy beliefs in the endurance sport would be an important
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45 151 step in the development and delivery of self-efficacy interventions (Short & Ross-Stewart, 2009).

48 152 The current study, therefore, sets out to investigate the sources of self-efficacy in the endurance
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50 153 sport domain. Specifically, three research questions are proposed:

53 154 1. What is the salience of the different sources in the endurance sport domain?

SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 155 2. What specific information within these sources contributes towards self-efficacy for the
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5 156 endurance sport domain?
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8 157 3. How and why does this information contribute to self-efficacy beliefs for the endurance
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10 158 sport domain?
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Method**Research Philosophy**

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19 161 The current study was approached from a critical realist perspective. Central to critical realism is
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21 162 that ontology is not reducible to epistemology, and that human knowledge only captures a small
22
23 163 part of a deeper reality (Fletcher, 2017). As opposed to positivist or constructivist perspectives,
24
25 164 critical realism treats the world as theory-laden, but not theory-determined (Danermark, Ekström,
26
27 165 Jakobsen, & Karlsson, 2002). Those who adopt a critical realist perspective can gain knowledge
28
29 166 ‘in terms of theories, which can be more or less truth like’ (Danermark et al., 2002, p. 10). **This**
30
31 167 **acknowledgement and acceptance of theories in critical realism, provides further justification for**
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33 168 **its use in the current study, given the current study’s focus on Bandura’s social-cognitive theory**
34
35 169 **(Bandura, 1989).**
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Research Design

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43 171 The current study employed a qualitative design, using semi-structured interviews for data
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45 172 collection. Semi-structured interviews help provide an understanding of an individual’s
46
47 173 perceptions and experiences, and allow a more in-depth investigation of these than can be achieved
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49 174 in focus group settings. Given that the sources of self-efficacy are predominately represented by
50
51 175 an individual’s perceptions (e.g. physiological states) or their experiences (e.g. past performance
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53 176 experiences), this provided a justification for the use of semi-structured interviews (Bandura,
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 177 1997). Semi-structured interviews have been successfully used previously to identify sources of
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5 178 self-efficacy in academic (Britner & Pajares, 2006) and sporting contexts (Samson, 2014; Valiante
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7
8 179 & Morris, 2013) as well.
9

10 11 180 **Participants**

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14 181 Following university ethical approval, twelve experienced competitive endurance athletes (seven
15
16 182 males, five females) were recruited for the study. Participants were recruited through prior
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18 183 completion of an online survey¹ ($n = 5$), social media ($n = 5$) and from emails ($n = 2$). **Participants**
19
20 184 **were told that the study would entail discussing their self-belief as athletes, and how this self-belief**
21
22 185 **has formed and developed over time.** Four endurance sports were represented: distance running
23
24 186 ($n = 4$), triathlon ($n = 4$) swimming ($n = 2$) and cycling ($n = 2$). Eligibility criteria for the study
25
26
27 187 required participants to have been competing in an endurance sport for at least five years, to have
28
29 188 completed at least two competitive events, races or competitions over the previous year, and to be
30
31 189 currently training at least three times week. Participants had a mean age of 40.76 ± 12.25 years,
32
33 190 had been competing in their chosen endurance sport for an average of 12.2 ± 6.25 years, and trained
34
35 191 for 11.58 ± 2.81 hours a week. Seven of the participants were age-group competitors, three were
36
37 192 club level athletes, and two were current age record holders.
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42 193 **Interview Protocol Development**

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45 194 The first stage in the development of the interview protocol was to consult previous research which
46
47 195 had investigated the sources of self-efficacy using a qualitative approach (Britner & Pajares, 2006;
48
49 196 Samson, 2014; Valiante & Morris, 2013). Examination of the interview protocols used in these
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55 ¹ The online survey related to the initial validation of a new endurance sport self-efficacy scale, and formed the
56 basis of Study 2 in Anstiss, Meijen, Madigan, & Marcora (2018).
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 197 studies revealed a common pattern of asking participants for their confidence in the specific
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5 198 domain being investigated, and then exploring the participant's rationale for the score that they
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7
8 199 gave, using the sources of self-efficacy as follow up questions. A similar approach was therefore
9
10 200 adopted for the current study.

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12
13 201 In line with the recommendations of Marshall and Rossman (2014), initial questions in the
14
15 202 interview were designed to access descriptive information before addressing questions specific to
16
17 203 the study. During these initial questions, participants were also encouraged to discuss why they
18
19 204 had taken up their endurance sports, their reasons for taking part, and what they enjoyed about it.
20
21 205 Following this, participants were asked to rate the confidence they had in their abilities to perform
22
23 206 well in their specific endurance sport on a scale of 0 (no confidence at all) to 100 (completely
24
25 207 confident). Participants were asked why they gave the confidence rating that they did. The semi-
26
27 208 structured questions then focused around the five sources of self-efficacy. Examples of questions
28
29 209 used were: "To what extent do you think your past experiences contribute to your confidence
30
31 210 rating?", "Are there any people who influence your confidence rating?" "How does how you feel
32
33 211 physically contribute towards your confidence rating?". After the discussion on the proposed
34
35 212 sources of self-efficacy, participants were also asked if there were any other factors that influenced
36
37 213 their belief in themselves. For those participants who reported a lower level of self-efficacy in
38
39 214 their own abilities (a confidence rating of 70 or lower based on the generally high levels of self-
40
41 215 efficacy reported by athletes; Feltz et al., 2008) they were asked an additional question "What
42
43 216 would need to occur for your confidence rating to increase?" In line with qualitative practice, open
44
45 217 rather than closed questions were used to encourage elaboration (Marshall & Rossman, 2014). The
46
47 218 interview protocol was piloted with two endurance athletes, who gave feedback and comments on
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 219 the clarity of questions. Potentially leading questions were rephrased and additional information
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5 220 explaining the confidence rating were added. A full interview protocol is available on request.
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8 **221 Procedure**
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11 222 Prior to the start of the interviews all participants provided informed written consent. Ten of the
12
13 223 12 interviews were conducted through either phone ($n = 4$) or Skype calls ($n = 6$), the other two
14
15 224 interviews were conducted in person at the lead researcher's University Department office.
16
17 225 Interviews were conducted between March and June 2016, with one interview generally occurring
18
19 each week. Although some disadvantages of Skype interviewing have been noted in the literature
20
21 226 (e.g. missing social cues, technical issues), the advantages of online interviews (e.g., allowing
22
23 227 contact with geographically distant participants) are established (Smith & Sparkes, 2016). The
24
25 228 beginning of the interview was spent establishing guidelines, and what to expect in terms of
26
27 229 questions. Participants were also told that they would receive a copy of the interview transcript to
28
29 230 check for accuracy. All interviews were carried out by the lead researcher and recorded by a
30
31 231 Dictaphone. Throughout the interviews, the lead researcher took notes to highlight areas for further
32
33 232 probing and to help ensure adequate pacing. This pacing refers to the need to ensure that
34
35 233 participants did not feel rushed within the interview (i.e. a constant barrage of follow-up questions)
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37 234 and that each component of the interview (i.e. the different sources of self-efficacy) was given
38
39 235 sufficient time to be discussed.
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46 237 Recordings were transcribed verbatim. Interview length ranged from 35 to 52 minutes. All
47
48 238 transcripts were proofread and checked for accuracy by the lead investigator. Only minor
49
50 239 discrepancies related to misheard geographical place names were reported by participants checking
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52 240 for accuracy.
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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241 **Analysis**

242 Analysis was carried out using Nvivo software (Version 10) using a deductive thematic analysis.
243 Deductive thematic analysis was chosen as the current study had clear theoretical links (socio-
244 cognitive and self-efficacy theory), was approached from a critical realist perspective, and the
245 research questions pertained to the a priori established sources of self-efficacy (Bandura, 1997).
246 Thematic analysis was also deemed suitable as the research questions related to the sources of self-
247 efficacy across endurance sport, and thematic analysis allows for an understanding of patterns
248 across individuals (Braun & Clarke, 2006).

249 This analysis involved six phases: familiarisation with data (reading and re-reading the
250 data, noting initial ideas); generating the initial codes (identifying the proposed sources of self-
251 efficacy, collating data relevant to each source); searching for themes (collating codes into
252 potential themes, gathering all data relevant to each potential theme); reviewing themes (checking
253 if the themes work across participants and endurance sports); defining and naming themes (refining
254 specifics of each theme and sub-theme, generating clear definitions and names for each sub-theme,
255 generating clear inclusion and exclusion criteria); and producing the results (selecting illustrative
256 extract examples, relating the analysis to the research questions and the theoretical background)
257 (Braun & Clarke, 2006). **To start, a list of core codes (the sources of self-efficacy) were generated
258 in line with self-efficacy theory (Bandura, 1997). These were past performance experiences,
259 vicarious influences, social/verbal persuasions, physiological states, and emotional states.
260 Definitions for these core codes where based on Bandura's initial definitions (1997), and more
261 recent definitions (e.g. the splitting of physiological and emotional states; Feltz et al., 2008). The
262 'essence' of these core codes and their resultant themes is presented in Table 1. No constraints
263 were placed on how many sources a piece of information could be coded under. Information that**

SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 264 did not appear to fall under the proposed codes, but still appeared to be associated with self-
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5 265 efficacy, was labelled under the code of ‘Other’. This process was done to ensure that potentially
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8 266 relevant information was not missed. These codes then formed the basis for the initial themes,
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10 267 through which sub-themes were then examined. Each sub-theme was judged to capture “something
11
12 268 important about the data in relation to the research question(s) and represents some level of
13
14
15 269 patterned response or meaning within the data set” (Braun & Clarke, 2006, p. 82).

16
17
18 270 To help promote trustworthy and credible data, a number of procedures were carried out
19
20 271 by the research team. First, throughout the analysis process, an audit trail was kept by the lead
21
22 272 researcher in the Nvivo program. This audit trail detailed information pertaining to how and why
23
24 273 raw information was coded, and also information pertaining to the generation of themes. This
25
26
27 274 process helped encourage greater levels of reflection, and also promoted a consistent logical
28
29 275 approach to the analysis. Second, a process of critical dialogue between the lead researcher and
30
31 276 other members of the research team was employed. The purpose of this critical dialogue was to
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33
34 277 encourage reflection upon, and exploration of, the different interpretations of the transcribed data
35
36 278 (Smith & McGannon, 2017). This process led to the refinement of several of the themes. Third, to
37
38 279 promote resonance in the work, illustrative quotes are provided in the results section, to enable
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40
41 280 readers to interpret the data in the most meaningful and transferable way to them (Braun & Clarke,
42
43 281 2006).

282 Results

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49 283 Past performance experiences, physiological states, social and verbal persuasions, and emotional
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51 284 states were identified as themes, and six sub-themes within these four themes were identified from
52
53 285 the analysis. ‘Cumulative experiences’ and ‘challenge and adversity’ were identified as sub-
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56 286 themes in the theme of past performance experiences. A sub-theme named ‘physical familiarity’

SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 287 was identified drawing from both past performance experiences and physiological states. From
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5 288 social and verbal persuasions, two sub-themes were identified, 'social support' and 'self-talk'. One
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7 289 sub-theme was identified from emotional states which was 'doubt and worry'. No theme was
8
9 identified for vicarious influences. The themes and their sub-themes are presented in Table 1.
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13 291 **[INSERT TABLE 1 NEAR HERE]**
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16 292 **Past Performance Experiences**
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19 293 Past performance experiences was the most cited source of self-efficacy. The athletes talked about
20
21 294 how their experiences in training and in competitions, races, and events contributed towards their
22
23 295 self-efficacy. Past performance experiences were the core 'framework' of their self-efficacy
24
25 296 beliefs as it gave them clear examples and reference points of what they were capable of achieving.
26
27 297 The training process was also mentioned, as participants felt that their confidence in their own
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29 298 abilities arose from knowing that what they completed in training could be translated to more
30
31 299 competitive environments. Within past performance experiences the first sub-theme that was
32
33 300 identified was cumulative experiences.
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38 301 **Cumulative experiences.** Rather than focusing on one particular event or success, the
39
40 302 endurance athletes drew on the volume and consistency of their experiences and successes. This
41
42 303 focus had led to a gradual increase in self-efficacy over time, with each new event and experience
43
44 304 adding to the already existing framework of experiences. R1, a distance runner, described this
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46 305 occurrence:
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50 306 I think its gradually increased over time - as I've increased the distance... so I've done 10 mile
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52 307 runs and 10k runs, and then you're thinking well I'll do a half-marathon and I think with each
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54 308 race you gain more confidence.
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 309 This culmination of experiences and successes enabled endurance athletes to gain an
4
5 310 accurate awareness of their own performance capabilities. S1, a marathon swimmer, described this
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7
8 311 process when discussing one of their most difficult swims:

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10
11 312 I didn't jump in immediately and say I was going to swim the channel or I am going to swim
12
13 313 round {redacted}, which I did last year, which is 44 miles. I incrementally increased year upon
14
15 314 year. As I could push the boundaries out of what I was achieving I knew I could do a little bit
16
17 315 more, it gave me the ability in the self-belief to know that actually let's have a go swimming
18
19
20 316 around {redacted}, let's do 44 miles.

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22
23 317 Further support for the role of cumulative experiences in helping raise self-efficacy was
24
25 318 provided by T3, a triathlete, who discussed having a low level of self-efficacy in their own ability.
26
27 319 When asked what would help raise this, they commented:

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29
30 320 I think for that confidence to increase is just a matter of time, and just a matter of competing
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32 321 more at half ironman distance or stepping up to full ironman distance. I think it is a matter....
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34
35 322 just a matter of time. The sheer number of races.

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37
38 323 **Challenge and adversity.** In addition to the volume and consistency of experiences, the
39
40 324 second sub-theme identified centred on the experiences of having persevered and/or worked
41
42 325 through challenging or adverse situations. The role and importance of these experiences was raised
43
44
45 326 by T2, a triathlete:

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47
48 327 So I think in triathlon you can draw on races that have been hard or times that you have struggled
49
50 328 and knowing that you have overcome them and managed to finish it, or do better than you think
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52 329 anyway - so I think those experiences definitely, definitely are really important.
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 330 Several of the endurance athletes also mentioned drawing on experiences of overcoming
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5 331 adversity from outside the endurance sport domain. This included experiences in other sports and
6
7 332 exercise settings, but also other non-exercise related experiences including childbirth,
8
9 333 bereavement, and redundancy from work. Each of the experiences helped provide the athletes with
10
11 334 an understanding of their own coping capabilities. T4, a triathlete, discussed how their experiences
12
13 335 as a multi-sport athlete during their childhood and adolescence contributed to their beliefs:
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16

17 336 I was an athlete as a kid, so there's some of that that's given me that confidence as well. You
18
19 337 know I know how to push through these things ... You know softball and basketball aren't quite
20
21 338 triathlon, but you still have confidence in your athletic ability. Say even though it's not from
22
23 339 endurance sport per sé, knowing that you can push through difficulties, issues and negative
24
25 340 aspects from softball and basketball, that's what's helped.
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30 341 **Physiological States**

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32
33 342 Physiological states was mentioned extensively by the athletes. The athletes described both the
34
35 343 sensations they feel when taking part in their endurance sport (e.g. pain, fatigue, cramping) but
36
37 344 also those which occur more chronically, such as the sensations felt in the build up to an event.
38
39 345 The athletes reinforced that how their body was feeling was an important factor in their perceived
40
41 346 capability for what they were about to engage in. In order to guide this process, the athletes
42
43 347 described comparing their current sensations to those that they had experienced previously. These
44
45 348 points helped form the basis of the sub-theme of physical familiarity.
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49 349 **Physical familiarity.** When performing in their endurance sport the endurance athletes
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51 350 were constantly engaged in an appraisal process of their physical sensations (e.g. pain, discomfort,
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53 351 fatigue, exertion). This appraisal was based on an athlete's own prior experience of knowing what
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 352 their body should be feeling and a knowledge of the work required to complete their task.

4
5 353 Therefore, it represented a combination between the sources of past performance experiences and

6
7 354 physiological states. Dissonance between the perceived and the expected could result in a lowering

8
9 355 of self-efficacy, as it could suggest that the athlete was not capable of meeting the demands of the

10
11 356 task or their own expectations. R2, a distance runner, discussed this awareness of their own body:

12
13 357 I'm kind of very, very aware of feelings within my own body - in terms of what feels right and

14
15 358 what feels wrong. What feels bad and what feels good. I do know if that I get to 1k or 2k in a

16
17 359 5k race, and I feel like I'm running through treacle already it's probably not going to be a good

18
19 360 result.

20
21 361 In comparison, congruence between the current sensation and the expected sensation

22
23 362 ensured that self-efficacy remain unchanged even when faced with 'negative' physiological

24
25 363 sensations as pain, fatigue, and exertion. S2, a marathon swimmer, spoke about the sensations of

26
27 364 pain that they often encountered during long swimming events:

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29 365 I know that for example after about 8 hours the biceps of my arms get really sore and I know

30
31 366 that after 9 hours I would have swum through it. So when I get to that point, I say to myself you

32
33 367 can just keep going you know this is going to go, and you just keep doing it.

34
35 368 **Verbal and Social Persuasions**

36
37 369 Verbal and social persuasions were described as playing an important role in the reinforcement of

38
39 370 efficacy beliefs by the endurance athletes. Verbal and social persuasions were described as being

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41 371 most impactful following a successful experience, as it helped reinforce that experience for the

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43 372 athlete. The athletes also described the use of self-talk as a method of reinforcing their own

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45 373 perceived capabilities.

SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 374 **Social support.** Endurance athletes drew social support from both domain specific sources
4
5 375 (coaches/training partners) but also from friends and family. For those athletes who trained with
6
7 376 coaches or training partners, the perceived credibility and expertise of the social support was
8
9 377 important in the both formation and reinforcement of efficacy beliefs. T4 recalled the support they
10
11 378 received from their coach and training partner before a major event:

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14
15 379 Having the girl I train with and my coach telling me that I'm the fittest I've ever been, that "It's
16
17 380 your day - Go and do it, and show us what you can do". And when you know that someone of
18
19 381 that ability is saying that to you - then you know that you can do it... and it kind of gives you
20
21 382 the belief that you can do it

22
23
24
25 383 As well as reinforcing existing self-efficacy beliefs, verbal persuasions were also beneficial
26
27 384 in challenging an athletes own conceptions of their ability. T2 discussed how their coach
28
29 385 encouraged them to alter their belief on what they were capable of using a combination of verbal
30
31 386 encouragement and performance experiences.

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33
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35 387 And I said 'no I can't do it' and they said 'yes you can'. So I did and when it was all done I ran
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37 388 8'10s (mile pace) or something stupid and now I'm like 'ooh I can do it'. So you know. That's
38
39 389 how my coach works on trying to show me. You do have the ability, but you talk yourself down.
40
41 390 So that's kind of how they try to lift me is by showing me that I can do it.

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44
45 391 Outside of coaches, training partners and significant others were also an important source
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47 392 of verbal persuasion. C2 raised the importance of verbal confirmation from their training partners
48
49 393 and girlfriend:

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52 394 I would say listening to the people who I train with and the listening to my girlfriend it does
53
54 395 affect me. It affects me in a positive way because it's given me an uplift and if people can see

SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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1
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3 396 it in me, then I think that's got to be there, obviously that reinforces the positive feelings of I
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5 397 can.

8 398 **Self-talk.** Ten of the twelve athletes described using self-talk throughout events. Self-talk
9
10 399 was primarily used to help reinforce an individual's capability for performing a task and the
11
12 400 athletes suggested they used it most frequently in difficult or challenging situations. C1, a cyclist,
13
14 401 mentioned how self-talk was important for reaffirming their ability during difficult periods in a
15
16 402 race:

20 403 There always is that sort of conflict in your own mind... when the race is hard, you try to tell
21
22 404 yourself, 'it's going to get easier', or 'I can push through this'. I've gone harder, I've gone
23
24 405 harder.

28 406 The type of self-talk (instructional/motivational) used also changed based on the situation.
29
30 407 When athletes believed they were capable of performing well in a situation, self-talk was more
31
32 408 likely to become positive and confirmatory, reinforcing the current experiences. Conversely, in
33
34 409 situations where an athlete may have low self-efficacy (for example the swimming component of
35
36 410 a triathlon) athletes instead often adopted motivational self-talk. T3, a triathlete, raised how the
37
38 411 type of self-talk varied during triathlon:

42 412 It's very much situational based. If for example, I'm swimming, my swimming is my weakest
43
44 413 discipline so particularly in open water I consider myself very inexperienced as an open water
45
46 414 swimmer so I will be trying to give myself motivation, remind myself of the technique, remind
47
48 415 myself of the bigger picture rather than actually allowing the self-doubt, the negativity to creep
49
50 416 in. Whereas something like cycling I've got a much better understanding of what my cycling
51
52 417 abilities are and what my limits are. Again, under those circumstances I talk to myself much

SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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1
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3 418 less. But when I do, it's more around "Yeah this is a really quick ride" or "things are going
4
5 419 well".

6
7
8 420 **Emotional States**

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10
11 421 Emotional states was a source of self-efficacy talked about less frequently. Although the athletes
12
13 422 felt that both positive and negative emotions were constant in their endurance sport, they felt that
14
15 423 these did not contribute significantly towards the creation or reinforcement of their own efficacy
16
17 424 beliefs. Despite this, doubt and worry was identified as a sub-theme in relation to the feelings of
18
19 425 the athletes prior to an important competition, race or event.

20
21
22
23 426 **Doubt and worry.** Doubt and worry primarily occurred when athletes were attempting to
24
25 427 push the boundaries of their own performance, as they did not have the prior experience of success
26
27 428 to draw on. These sensations of anxiety could in turn influence self-efficacy beliefs. T1, a triathlete
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29 429 who was making the change from Olympic triathlon to Ironman triathlon, remarked on this feeling:

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33 430 It's inexperience right, I haven't biked 180 Km ever, which is the bike portion of the race, and
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35 431 it gets me a bit worried sometimes. Running a marathon as well like it is just sort of, running a
36
37 432 marathon is like this huge social thing whatever, it is a bit worrying....

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41 433 However doubt and worry were not always regarded as a negative. In comparison, the
42
43 434 majority of the athletes felt that the sensations of doubt and worry they experienced led to better
44
45 435 levels of preparation and performance. R3, discussed this:

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47
48 436 In my view you need to have that bit of doubt, that bit of doubt you see keeps you on edge,
49
50 437 keeps you sharp, it keeps you just at the sweet spot, that you know for example in a full
51
52 438 marathon you know you have got to prep. You know what you have got to take on, you know

SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 439 you got to fuel properly, you know you have got to do all your things that prepare. Being
4
5 440 cavalier about it leads to too many things that could go wrong.
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11 442 **Discussion**
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13
14 443 This study investigated the sources of self-efficacy in endurance athletes. In line with previous
15
16 444 research (Samson, 2014), our findings highlighted that endurance athletes drew on several sources
17
18 445 in the formation and maintenance of their self-efficacy beliefs, in particular past performance
19
20 446 experiences, physiological states, social and verbal persuasions, and emotional states. Within these
21
22 447 sources, cumulative experiences, challenge and adversity, physiological familiarity, social support,
23
24 448 self-talk, and doubt and worry were identified as sub-themes. No consistent theme was identified
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26 449 for vicarious experiences.
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31 450 Past performance experiences was were identified as the key source of self-efficacy for the
32
33 451 endurance athletes in the current study. This finding is in line with both theory (Bandura, 1997;
34
35 452 Maddux, 1995) and prior research (Feltz et al., 2008; Valiante & Morris, 2013), which has
36
37 453 established past performance experiences as being the most powerful source of self-efficacy.
38
39 454 Singular dramatic experiences have been suggested to be a key factor in the formation of efficacy
40
41 455 beliefs (Ericsson & Anders, 2006) but in the current study the athletes alluded more to both the
42
43 456 volume and consistency of their own experiences. These cumulative experiences helped provide
44
45 457 the athletes with a clear understanding of their own capabilities, which resulted in gradual increases
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47 458 in self-efficacy over time. This gradual increase in self-efficacy may also result from the perceptual
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49 459 and physiological adaptations which occur over time due to training. Future research which
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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2
3 460 examines the relationship between self-efficacy and perceptual/physiological adaptations from
4
5 461 training is warranted.
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8 462 Experiences of challenge or adversity was also identified as a central source of self-
9
10 463 efficacy. Bandura (1997) claimed that successes that occurred despite difficulties and adversity
11
12 464 would contribute more towards self-efficacy than success that came without difficulty. Although
13
14 465 the majority of the athletes drew on experiences from within the endurance sport domain, several
15
16 466 also discussed drawing on experiences from other non-sporting related domains. Self-efficacy
17
18 467 theory hypothesises that experiences which occur within a specific domain will be the most
19
20 468 powerful contributor towards self-efficacy (Bandura, 1997), but, as the present study clearly
21
22 469 demonstrates, other non-domain experiences can also contribute. This contribution from non-
23
24 470 domain experiences is likely to occur when individuals are able to identify shared subskills
25
26 471 between the experiences (Bandura, 1997). Specifically, this focus on adversity related experiences
27
28 472 may be related to coping self-efficacy. Coping self-efficacy is hypothesised to be more
29
30 473 generalizable than other forms of self-efficacy (Bandura, 2002; Chesney et al., 2006), where if an
31
32 474 individual believes they can utilise various coping skills when faced with stressors, this belief is
33
34 475 likely to generalise across domains. Caution must be taken, however, when considering the role of
35
36 476 adversity related experiences in helping form self-efficacy beliefs. Overcoming adversity has been
37
38 477 suggested to lead to positive improvements in several psychological constructs (Sarkar, Fletcher,
39
40 478 & Brown, 2015), but it may also be that the reason for overcoming the adversity was the presence
41
42 479 of initial constructs, such as self-efficacy (Savage, Collins, & Cruickshank, 2017). Therefore it
43
44 480 may be that adversity related experiences help reinforce self-efficacy beliefs, rather than create
45
46 481 new ones, and only individuals who already possess robust self-efficacy beliefs may be successful.
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 482 Previous research which has examined the role of physiological states has largely focused
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5 483 on perceptions before an event (Chase, Feltz, & Lirgg, 2003; Samson, 2014). In the current study,
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7 484 however, physiological states were predominately mentioned in relation to performing the task
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9 485 itself. Rather than a discussion on particular states or sensations, what was identified from the
10
11 486 analysis was a concept of constant physical appraisal. This constant appraisal of current
12
13 487 physiological states represents what is known as a ‘proximal’ source of self-efficacy (Maddux,
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15 488 1995). Proximal sources of self-efficacy are immediate and current sources that inform perceived
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17 489 capabilities when engaging in a task (Maddux, 1995). This appraisal focused on a comparison
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19 490 between the current sensations (proximal) and the expected sensations which were based on
20
21 491 previous experiences. These previous experiences in turn represent a ‘distal’ source of self-
22
23 492 efficacy. Distal sources are those based on experiences and information received in the past. This
24
25 493 concept of physical familiarity, and its drawing together of physiological states and past
26
27 494 performance experiences also reinforces the theoretical prediction that the sources of self-efficacy
28
29 495 overlap (Bandura, 1997). The relationship between distal and proximal sources of self-efficacy
30
31 496 has, surprisingly, not received much explicit attention in the self-efficacy literature (Maddux,
32
33 497 1995). In comparison, this monitoring of the current physiological state (interoception) and the
34
35 498 appraisal between current physical sensations and expected sensations has been highlighted and
36
37 499 documented in several areas of research relating to endurance performance (Brick, MacIntyre, &
38
39 500 Campbell, 2016; Tucker, 2009). Research has not, until this study, explicitly linked this process to
40
41 501 self-efficacy. Given that this process can provide individuals with an understanding of their current
42
43 502 progress towards a task and their capabilities for achieving this, it is likely to directly influence
44
45 503 self-efficacy. Severe dissonance might lead to individuals perceiving that they do not possess the
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47 504 capabilities to achieve their goals and therefore they might disengage from the task. Evidence
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 505 comes from research into ultramarathons where unexpected pain at early stages was one of the
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5 506 most significant predictors of withdrawal from the event (Hoffman & Fogard, 2011).
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8 507 Social support and verbal encouragement have been previously demonstrated to be
9
10 508 effective tools to help raise an athlete's self-efficacy (Feltz et al., 2008) and the current results
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12
13 509 support this. Central to the role of social support and verbal encouragement were both the
14
15 510 perceived expertise of the provider and the relationship with the athlete. These two mediating
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17 511 factors have also been supported by prior research into self-efficacy (Valiante & Morris, 2013)
18
19 512 and social support (Rees & Freeman, 2007). Self-talk was also identified as a key source of self-
20
21 513 efficacy. This finding links with prior research which has demonstrated that both distance runners
22
23 514 (Samson, 2014) and professional golfers (Valiante & Morris, 2013) make use of self-talk to help
24
25 515 maintain their efficacy beliefs.
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30 516 Emotional states was not as widely discussed as the other sources of self-efficacy, with
31
32 517 only worry and nerves emerging as a consistent sub-theme. This result is not entirely surprising,
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34 518 as other researchers have often failed to demonstrate a clear impact of emotional states on self-
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36 519 efficacy (Samson, 2014; Valiante & Morris, 2013). This, however, does not mean that emotional
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38 520 experiences are not present in endurance performance, but rather that how they contribute to self-
39
40 521 efficacy remains unclear. It has been argued that emotional states may better be understood as a
41
42 522 moderating factor on the relationship between past performance experiences and self-efficacy
43
44 523 rather than existing as a standalone source (Feltz et al., 2008; Maddux, 1995).
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49 524 Although some athletes discussed making comparisons with others competitors, no
50
51 525 consistent themes were identified within the source of vicarious influences. Other research has also
52
53 526 often failed to find an impact of vicarious influences on self-efficacy in experienced athletes
54
55 527 (Samson, 2014; Valiante & Morris, 2013). This may be because vicarious influences are
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 528 hypothesised to contribute most to self-efficacy when individuals are first engaging in a behaviour,
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5 529 as they lack suitable past experiences to draw on (Bandura, 1997).
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8 **530 Implications**
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11 531 From these findings the current study offers several theoretical implications. First, advancing
12
13 532 previous qualitative research on sources of self-efficacy (e.g. Samson, 2014), the current study is
14
15 533 the first to identify sources of self-efficacy specific to the endurance sport domain. Alongside this
16
17 534 identification of specific information, the current study also provided some insight into how and
18
19 535 why this information may contribute towards self-efficacy. This is apparent based on the theme of
20
21 536 “physical familiarity”. The current study also provided evidence for the overlap that may exist
22
23 537 between the sources of self-efficacy. Despite often being depicted as distinct entities, the sources
24
25 538 of self-efficacy do possess a significant amount of overlap (Bandura, 1989; 1997). It may therefore
26
27 539 be worthwhile for researchers to begin to move away from considering the sources of self-efficacy
28
29 540 as ‘distinct’ entities. A consideration of specific experiences and information, and the cognitive
30
31 541 processes that accompany these, could provide more theoretically informed interventions than
32
33 542 those which only focus on specific sources of self-efficacy (Feltz et al., 2008; Short & Ross-
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35 543 Stewart, 2009).
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42 544 Alongside the theoretical implications, the current study also offers applied implications.
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44 545 First, interventions aimed at increasing self-efficacy should look to cover several of the sources of
45
46 546 self-efficacy preferably in unison (Short & Ross-Stewart, 2009). In order to achieve this it may be
47
48 547 beneficial to either expose athletes to experiences which contain several of the sources or ask them
49
50 548 to reflect on experiences which have. Specifically, reflection on experiences of overcoming
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52 549 challenge or adversity may be particularly beneficial to endurance athletes. Athletes who do not
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54 550 possess enough endurance sport domain experience in managing common endurance sport
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 551 demands such as pain and discomfort (McCormick et al., 2018), could reflect on their experiences
4
5 552 in other domains. Most individuals have likely overcome some difficulty or adversity in an aspect
6
7 553 of their life, and being able to encourage athlete's to draw on these experiences could be beneficial
8
9 554 and help improve or reinforce an individual's self-efficacy, particularly related to coping.
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13 555 Limitations and Future Research

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16 556 It is also important to consider the limitations of the current study. The use of one-off semi-
17
18 557 structured interviews as a data collection technique may have resulted in an over-simplified
19
20 558 understanding of the sources of self-efficacy. Additionally, research investigating the sources of
21
22 559 self-efficacy has often attempted to include both individuals high and low in self-efficacy (Pajares
23
24 560 & Urdan, 2005), but the majority of participants in the current study reported high levels of self-
25
26 561 efficacy in their own abilities. It may be that the formation and maintenance of self-efficacy beliefs
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28 562 in high self-efficacy individual could be qualitatively different than low self-efficacy individuals.
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33 563 The findings discussed in this study offer several avenues for future research. Research
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35 564 which attempts to examine if these findings are replicated in different samples of endurance
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37 565 athletes (e.g. elites or athletes with lower levels of self-efficacy) would help demonstrate if the
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39 566 sources of self-efficacy identified in this study are common across the whole endurance sport
40
41 567 domain. Additionally, whereas the current study attempted to and succeeded in identifying shared
42
43 568 sources of self-efficacy across endurance sports, future research could attempt to identify
44
45 569 discipline or distance specific sources of self-efficacy. Understanding these sport specific sources
46
47 570 is the next logical step from the current study and would allow further refinement of interventions
48
49 571 and promotion of self-efficacy in endurance athletes. Future research could also investigate how
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51 572 self-efficacy beliefs may change during endurance events. Given that endurance events or
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53 573 competitions can last between several hours to several days, this provides ample time for changes
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

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3 574 in self-efficacy to happen (Gist & Mitchell, 1992). These in-event changes are likely to relate to
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5 575 an interaction between the different sources of self-efficacy (e.g. distal past performance
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7 576 experiences and proximal physiological states). Examinations of these interaction between the
8
9 577 sources, and potential moderators or mediators of these interactions, would help provide
10
11 578 theoretical and practical implications.
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15 579 In conclusion the current study provides a novel contribution to the literature on self-
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17 580 efficacy in the sport domain. It identifies domain specific sources of self-efficacy for endurance
18
19 581 athletes and reinforces several key tenets of self-efficacy theory, specifically, how the salience of
20
21 582 the sources may change based on task demands, and also the overlap between the sources of self-
22
23 583 efficacy. Within these domain specific sources of self-efficacy, the role of cumulative experiences,
24
25 584 experiences of challenge and adversity and a sense of physical familiarity were identified as key
26
27 585 sources of endurance athlete's self-efficacy. These findings can be useful in the design and delivery
28
29 586 of self-efficacy based intervention and also offer further avenues for future research.
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SOURCES OF SELF-EFFICACY IN ENDURANCE ATHLETES

732 **Table 1. Overview of Themes and Sub-Themes**

733

Themes (Sources of Self-Efficacy)	Essence of theme (Bandura, 1997)	Sub-themes	Essence of the sub-theme
Past Performance Experiences	Any references to the athletes' past experiences in their endurance sport. This included experiences in training and competition as well as both successes and failures.	Cumulative Experiences	Experiences build on each other in helping to provide an accurate and stable framework of perceived capability.
		Challenge and Adversity	Experiences of encountering and/or overcoming challenges and adversity.
Physiological States	Any references to perceptions of physical states.	Physical Familiarity	An endurance athlete's awareness of what their body should be feeling, when engaging in their endurance sport and what this meant in regards to their capabilities.
Social/Verbal Persuasions	Any references made about encouragement and/or support received from either others or oneself.	Social Support	Support received from both sporting related and non-sporting related others.
		Self-talk	Attempts made to enhance perceived capability through the use of self-talk
Emotional States	Any references to emotions, feelings or affect.	Doubt and Worries	Sense of worry and doubt over performance ability both prior to and while competing.