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To cite this article: Matthew J. Schweickle, Christian Swann, Patricia C. Jackman & Stewart A. Vella (2020): Clutch performance in sport and exercise: a systematic review, *International Review of Sport and Exercise Psychology*, DOI: [10.1080/1750984X.2020.1771747](https://doi.org/10.1080/1750984X.2020.1771747)

To link to this article: <https://doi.org/10.1080/1750984X.2020.1771747>



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REVIEW



Clutch performance in sport and exercise: a systematic review

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ABSTRACT

Improved performance under pressure in sport and exercise has been termed clutch performance. The aim of this study was to systematically review, synthesise, and evaluate existing research on clutch performance. Specifically, this review explored: (i) research designs used to examine clutch performance; (ii) definitions of clutch performance; (iii) theoretical frameworks underlying clutch performance; (iv) how clutch performance has been measured; (v) the level of supporting evidence for clutch performance; and, (vi) evidence regarding how clutch performances occur. Ten electronic databases were searched in October 2019, with 27 studies found to meet the eligibility criteria included in the review. The results indicate that there is considerable definitional, conceptual, and measurement heterogeneity in the field of clutch performance. Multiple, conflicting definitions of clutch performance were identified in the literature, which consequently led to the adoption of two distinct approaches to examining clutch performance as: (i) an ability; or, (ii) an isolated episode of performance. These differing approaches have resulted in disparate measurement strategies, and accordingly, there was mixed evidence for the concept of clutch performance and how it occurs. In response to these issues, we propose four principles to help guide future research towards refined explanations of clutch performance.

ARTICLE HISTORY


Received 1 November 2019
Accepted 13 May 2020

KEYWORDS

Performance under pressure; subjective experience; psychology; optimal performance; anxiety

Increased performance under pressure in sport and exercise has been referred to as *clutch performance* (Otten, 2009; Swann et al., 2019). The term clutch performance is frequently applied by the media to many high-profile, celebrated sporting moments, such as Michael Jordan scoring with five seconds remaining to win the 1998 National Basketball Association (NBA) Championship (Woodyard, 2018); the New England Patriots' 31-point, second half comeback to win the 2017 Super Bowl (Hurley, 2019); and Sergio Aguero's injury time goal to win Manchester City's first Premier League title in 2012 (Hart, 2017). Recent evidence suggests that such clutch performances are intrinsically rewarding and motivating (Swann et al., 2017a), and that clutch performances can also occur in exercise

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 Supplemental data for this article can be accessed at <https://doi.org/10.1080/1750984X.2020.1771747>

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settings (Swann et al., 2019). As these performances occur under pressure, clutch performance has been considered psychological in origin (Otten, 2013). Facilitating clutch performance is therefore of great interest to researchers and practitioners in the field of sport and exercise psychology (Marchant et al., 2014; Otten, 2013).

The phrase 'in the clutch' was first used in a 1929 New York Times article to describe when a baseball batter hits a safe 'blow' at an opportune moment (Safire, 2005). Despite having a long history of colloquial use (e.g. West & Libby, 1969), scientific definitions of clutch performance have only emerged relatively recently. The most prominent definitions of clutch performance are those provided by Otten (2009) and Hibbs (2010). Otten (2009) defined clutch performance as 'any performance increment or superior performance that occurs under pressure circumstances' (p. 584). Hibbs (2010), meanwhile, defined clutch performance as:

when a participant in competitive sport succeeds at a competitive-related, challenging task during a clutch situation, is aware that the performance occurs during a clutch situation, possesses the capacity to experience clutch situation-related stress, cares about the outcome of the contest, and succeeds primarily due to skill rather than luck or cheating (p. 55).

A clutch situation, according to Hibbs (2010), is 'a point in a competitive sport where the success or failure of the participants has a significant impact on the outcome of the contest' (p. 48). Researchers have highlighted, however, that definitions of clutch performance remain problematic. For example, Seifreid and Papatheodorou (2010) noted that 'clutch exists as a challenging concept which is inadequately defined in sport' (p. 92), whilst Mesagno and Hill (2013) stated that clutch performance is 'ambiguously defined' (p. 275). Swann et al. (2017a), meanwhile, suggested that 'standard definitions of clutch performance may require refinement' (p. 2278). Definitional critiques have also centred on the situations in which clutch performances occur, based on evidence that clutch performances have been reported outside of competitive sport settings, such as in training (Swann et al., 2017a) and in exercise contexts (Swann et al., 2019). As such, questions remain over how to adequately define clutch performance, as well as the situations in which such performances occur.

Theoretical explanations of clutch performance have emerged from two different approaches. Traditionally, theories of performance under pressure have focused on choking, defined as 'an acute and considerable decrease in skill execution and performance when self-expected standards are normally achievable, which is the result of increased anxiety under perceived pressure' (Mesagno & Hill, 2013, p. 274). For example, attentional theories propose that, in response to anxiety, athletes either divert attention towards the self (e.g. self-focus theories; Beilock & Carr, 2001), or away from task-relevant cues (e.g. distraction theories; Oudejans et al., 2011). More recently, an Integrated Model of Flow and Clutch States has been proposed (Swann et al., 2017b, 2019). This model outlines that a specific psychological state may underlie clutch performance (i.e. clutch states), which overlaps with, yet is distinct from, the experience of flow (a deeply focused, absorbing, and autotelic experience; Csikszentmihalyi, 2002). As such, explanations of clutch performance have emerged out of research centred on either choking or flow.

A range of measurement approaches have been adopted to examine clutch performance. Research in this field began with Cramer's (1977) investigation into the existence of clutch hitters in baseball. For the subsequent 30 years, clutch performance research

was exclusively conducted within the sport of baseball, through the method of saber-metrics (i.e. the statistical analysis of baseball; Costa et al., 2019). Generally, such archival approaches have focused on whether clutch performance exists as an observable phenomenon in sport. In the last decade, however, there has been a considerable increase in the quantity and diversity of research examining clutch performance. For example, measurement approaches have extended to include qualitative methodologies that focus on the psychological state underlying clutch performance (e.g. Swann et al., 2017a), whilst experimental approaches have included measuring variables such as subjective experience (e.g. anxiety), technique changes in sport-specific skills (e.g. golf-putting stroke), and objective performance (e.g. putting accuracy) during clutch performances (e.g. Gray & Cañal-Bruland, 2015). In parallel, research has expanded into a wide range of sports beyond baseball, such as basketball (e.g. Otten, 2009), golf (e.g. Hill & Hemmings, 2015), and tennis (e.g. Jetter & Walker, 2015), as well as exercise (e.g. Swann et al., 2019).

There are fundamental questions surrounding the strength of evidence underpinning clutch performance as an observable phenomenon in sport. For example, Wallace et al. (2013) found no evidence for NBA players displaying clutch performances during the fourth quarter of playoff games. Similarly, Birnbaum (2008) demonstrated that clutch performance in Major League Baseball (MLB) was not a predictor of future clutch performances, casting doubt on the notion that certain players are more prone to producing clutch performances than others. In contrast, Jetter and Walker (2015) found that higher-ranked professional tennis players improved their winning percentage, both overall and in decisive sets (i.e. tiebreak sets), during important competitions (i.e. Grand Slam tournaments). This finding suggested that higher-ranked players are able to produce clutch performances when the incentives were greatest. Meanwhile, Solomonov et al. (2015) indicated that NBA players with reputations for being clutch players (i.e. known for producing repeated clutch performances) increased their output (e.g. points scored) in the last five minutes of critical games. However, these players' overall base performance (e.g. shooting percentage) did not increase. Solomonov et al. (2015) concluded that this finding provided limited evidence of clutch players, in that whilst these players scored more points, this was a consequence of shooting more often, rather than improved shooting accuracy. Thus, there is contradictory evidence as to whether clutch performance exists in sport.

Against the backdrop of definitional issues and conflicting evidence, a systematic review of clutch performance is both timely and important in terms of providing guidance on future directions for the field. Systematic reviews aim to be 'comprehensive, methodical, explicit, transparent, and as unbiased as possible in the questions they explore and how they explore them' (Siddaway et al., 2019, p. 97). Thus, systematic reviews aim to produce a summary of the literature that explores relations, contradictions, and gaps in a research field and the reasons for these. In turn, systematic reviews can allow broad and more robust conclusions to be drawn, which can outline future research directions and inform practice (Siddaway et al., 2019). Furthermore, systematic reviews have previously been employed as a method to review and bring clarity to constructs with definitional issues in the field of sport and exercise psychology (Dohme et al., 2017; Swann et al., 2015). These aspects are highly relevant to the field of clutch performance, which has yet to be systematically reviewed and synthesised, and may benefit from greater clarity and direction.

The aim of this study was to systematically review, synthesise, and evaluate the existing research on clutch performance. Specifically, this review addressed the following research questions: (i) what research designs have been used to examine clutch performance?; (ii) how has clutch performance been defined?; (iii) what theoretical frameworks have been used to explain clutch performance?; (iv) how has clutch performance been measured?; (v) is there supporting evidence for clutch performance in sport and exercise?; and, if so, (vi) what is known about the occurrence of clutch performances? In turn, this review seeks to address existing issues currently facing the field by providing definitional and conceptual clarity. Further, this review aimed to identify future directions for research on clutch performance, which can increase understanding of how practitioners, athletes, and exercisers can facilitate successful performance under pressure.

Methods

Protocol

The review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). The PRISMA checklist is reported in Supplementary File 1. The search strategy included 10 electronic databases, representing a combination of sport- (SPORTDiscus) and psychology- (PSYCInfo, PSYCArticles) specific databases, and general scientific databases (Academic Search Complete, SCOPUS, Pub Med, Medline, Web of Science, Science Direct, ProQuest Central). The final search was conducted in October 2019.

Potential search terms were initially developed by the authors, all of whom have published in the area of clutch performance. Combinations of these search terms were trialed by the first author on the EBSCOhost database. These preliminary searches were reviewed for relevance, and the search repeated until the most effective combination of search terms were identified (Siddaway et al., 2019). The aim of this process was to limit the amount of irrelevant results, whilst ensuring all relevant literature was retained. The final search string was: [clutch] AND [(sport* OR exerci* OR physical* OR athlet*)]. The singular use of the term *clutch*, rather than *clutch performance*, was chosen to capture terminology relevant to the concept, but that may not contain the term performance (e.g. hitting in the clutch, clutch shooting). The search terms physical* (e.g. physical fitness) and athlet* (e.g. athlete) were included as synonyms to supplement sport* and exerci*. Exercise was included in this review as recent evidence suggests that clutch performances may also occur in exercise settings (e.g. Swann et al., 2019). Where possible, the first block was searched in the title, abstract, and keyword field, whilst the second block was searched in the full text field. The full search strategy for each database is presented in Supplementary File 2.

Eligibility criteria

Inclusion and exclusion criteria were employed to ensure that the scope of the review was clearly defined, and that all literature relevant to the aims of the review was identified (Centre for Reviews and Dissemination, 2009; Siddaway et al., 2019). Criteria for inclusion were that articles must: (a) be a peer-reviewed journal article published in the English

language; (b) report original empirical evidence (including original analyses of secondary data); (c) be published prior to October 2019 (when the final search was undertaken); and, (d) examine the nature, existence and/or occurrence of clutch performance in participants' engaging in sport¹ (including sport-specific skills) or exercise², as defined by the World Health Organisation (WHO, 2018). Articles were excluded that (e) referred to clutch as a mechanical apparatus (e.g. a clutch in motorcycle sports). Following initial scoping of the literature, inclusion of original analyses of secondary data were deemed important for the current review. Specifically, archival studies comprise a significant portion of the extant literature, and consideration of these studies is pertinent to several aims of the review (e.g. how clutch performance has been measured).

Screening process

Following database searching, articles were imported and screened in Endnote X8 reference management software (Thomas Reuters, California), during which duplicates were automatically removed. Missed duplicates during this stage were removed manually during the screening process. Articles were independently screened at the title, abstract, and keyword level for relevance by the first and third author. Studies were retained if they contained the term clutch in the title, abstract, or as a keyword, appeared to involve participants in the domain of sport or exercise, and were not referring to clutch as a mechanical apparatus (e.g. in motorsports). A number of steps were followed to ensure that the screening process was as comprehensive as possible (Siddaway et al., 2019). If the relevance of an article was uncertain, the full text was obtained for further screening. Once full texts were obtained for all identified studies, a further manual search was conducted by the first author. Specifically, reference lists of all identified studies were searched, in addition to forward searching citations of identified studies using Google scholar. This process was repeated with each new study added. Lastly, authors who had two or more first-author publications at this stage of screening were contacted and asked to suggest any relevant literature that was not presently included (Siddaway et al., 2019). This resulted in two additional studies (Jackman et al., *in press*; Maher et al., 2018) being included, which had been published after the initial search date. After completing these steps, the first and third authors screened the full texts in accordance with the eligibility criteria. In three cases inclusion was uncertain (Cramer, 1977; Cramer & Palmer, 2008; Deane & Palmer, 2006) because it was not initially clear if original data had been analysed. Upon repeated readings and discussions, the reviewers agreed to include these papers as it was determined that original data had been analysed.

Data extraction and synthesis

Data were extracted by the first author. These data included: (i) study characteristics (methodology, study design, aims, hypotheses, theoretical framework); (ii) participant characteristics (sample size, gender, mean age, sport, expertise); and (iii) key findings relevant to the aims of the review (definitions, existence and occurrence of clutch performance). Given the heterogenous nature of the included studies, a narrative synthesis was undertaken. A narrative synthesis summarises and explains findings textually (Popay et al., 2006), with the aim of generating new insights (Thomas et al., 2012). A preliminary

synthesis was initially conducted by tabulating textual summaries of the data according to the review aims. Tabulation is valuable in developing initial summaries of the included studies, as well as facilitating identification of patterns across studies (Higgins et al., 2019). Following this preliminary synthesis, the relationships between studies were explored by examining factors that may explain differences in findings between studies (Popay et al., 2006). This was an important step as two of the five review aims related to empirical findings. An interpretative approach was taken, in which findings of the included studies were filtered according to the conceptual assumptions and methods adopted (Drisko, 2019). Specifically, this involved examining how research design, definitions, and measurement may have informed the results of individual studies.

Quality appraisal

Study quality was appraised using the 16-item assessment tool (QATSDD) developed by Sirriyeh et al. (2012).³ The QATSDD can be used to assess the quality of qualitative, quantitative, and mixed methods studies. However, criterion 14 of the tool was excluded on grounds of being ineffective for assessing reliability in qualitative research (Jaarsma & Smith, 2018; Smith & McGannon, 2018), whilst criterion 9 of the tool was excluded when scoring archival studies, as this criterion was deemed inappropriate for archival designs by the research team.

To limit bias, and facilitate transparency and trustworthiness, authors of the present review who were also authors on an included study were not involved in the quality assessment of that study. As such, the first author assessed 26 of the 27 studies, whilst the second, third, and fourth authors all assessed eight studies each. For the remaining studies, two independent reviewers were used. The first independent reviewer assessed four studies (three in conjunction with the first author, one in conjunction with the second independent reviewer), whilst the second independent reviewer assessed one study. All studies were assessed by two reviewers. As outlined in Sirriyeh et al. (2012), the reviewers met to discuss and deliberate on any scoring differences, following which a final score was determined by mutual agreement.

Results

In total, 4779 studies were identified across three separate searches. Following duplicate removal, 2548 studies were independently screened for relevance. The majority of studies screened at this stage were removed as they were not in the domain of sport or exercise (clutch is a prominent term in the fields of zoology and mechanical engineering). This process left 34 studies to be screened at the full text stage. An additional manual search identified 14 potentially relevant articles to be screened at the full text stage. Thus, 48 articles were screened at the full text stage. Following full text screening, 21 articles were excluded. Reasons for exclusion were that the studies: were not original empirical research ($n = 11$); did not examine the nature, existence and/or occurrence of clutch performance ($n = 5$); were not peer reviewed ($n = 2$); were not in the domain of sport or exercise ($n = 2$); and, were not written in English ($n = 1$). Accordingly, 27 articles were included in the systematic review. The PRISMA diagram of this process is provided in Figure 1.

Characteristics of included studies

Details of study characteristics, including type of sport/exercise, sample size, methodology, methods, approach to research design, and key findings relevant to aims of the review are presented in Table 1. In total, 17 studies were quantitative, six qualitative, and four mixed methods. Of the quantitative studies, 13 employed archival methods, whilst the remaining four studies used experimental methods. In the qualitative studies, both career-based and event-focused⁴ semi-structured interview methods were used. Three mixed method studies used a combination of psychometric measures and interviews (see Table 1 for measures), whilst one mixed methods study (Swann et al., 2016) included performance observation, naturalistic performance data, and event-focused, semi-structured interviews.

There were 545 (304 male, 241 female) participants from studies that collected primary data. Data were observed for at least 3652⁵ individuals from studies that obtained secondary data (i.e. archival methods). Meanwhile, six studies did not report the sample size in adequate detail to report. Participants were examined in a range of sports, including: baseball ($n = 8$); basketball ($n = 6$); golf ($n = 5$); mixed sport ($n = 3$); tennis ($n = 1$); and American football ($n = 1$). A mix of participants engaging in both sport and exercise was examined in

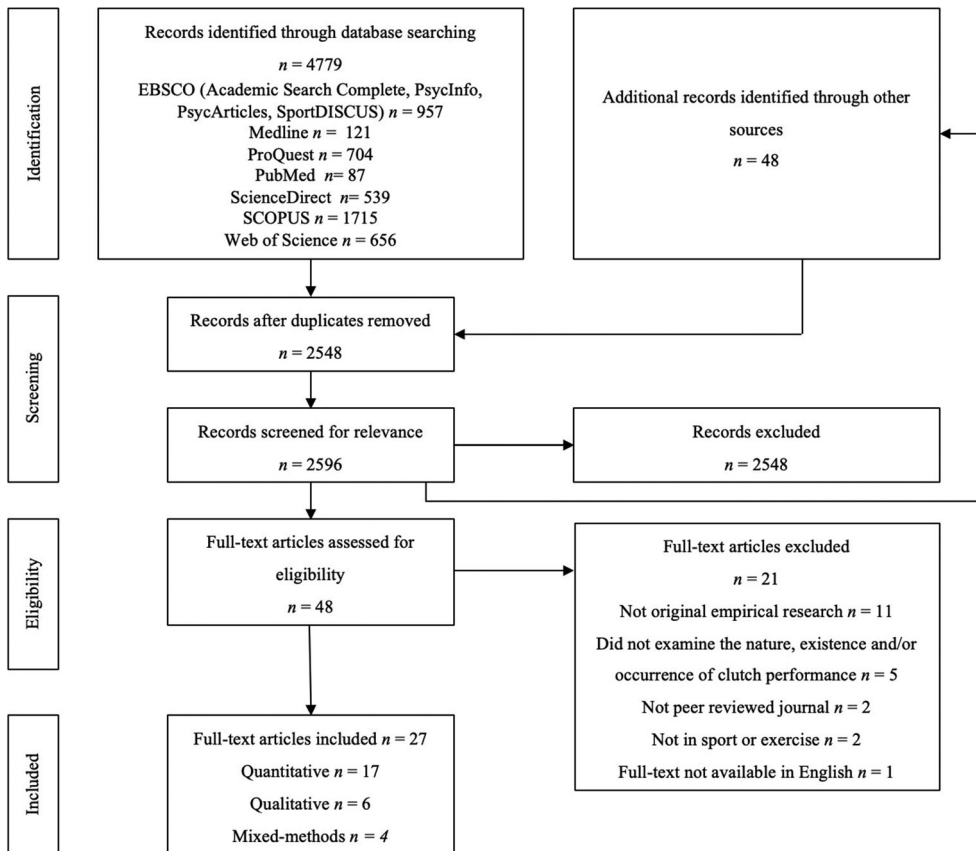


Figure 1. Flow diagram of database search and record screening.

Table 1. Overview of included studies.

| ID | Study | Sport/Exercise | Methods | Theory/Model | Sample size | Research Approach | Key findings relevant to existence of clutch performance and/or occurrence of clutch performance | QA |
|--------------|-------------------------------|----------------|-------------------------------|--------------------------|-------------------|-------------------|--|-----|
| Quantitative | | | | | | | | |
| 1 | Birnbaum (2008) | Baseball | Archival | N/S | N/S | Ability | No evidence of clutch hitters | 31% |
| 2 | Birnbaum (2009) | Baseball | Archival | N/S | N/S | Ability | No evidence of clutch pitchers | 23% |
| 3 | Brooks (1989) | Baseball | Archival | N/S | N/S | Ability | No evidence of clutch hitters | 44% |
| 4 | Cao et al. (2011) | Basketball | Archival | NET | N/S | Ability | No evidence of clutch free-throw shooting; shooters generally choke | 54% |
| 5 | Cramer (1977) | Baseball | Archival | N/S | N/S | Ability | No evidence of clutch hitters | 31% |
| 6 | Cramer and Palmer (2008) | Baseball | Archival | N/S | 897 | Ability | No evidence of clutch hitters | 44% |
| 7 | Deane and Palmer (2006) | Baseball | Archival | N/S | 501 | Ability | No evidence of clutch pitchers | 44% |
| 8 | Gray and Cañal-Bruland (2015) | Golf | Within-subjects experimental | Self-focus | 25 | Episode | Clutch performances characterised by lower heart rate, better putting accuracy, and more stable putting kinematics than choking performances | 62% |
| 9 | Gray et al. (2013) | Golf | Within-subjects experimental | Self-focus | 13 | Episode | Clutch performances characterised by better putting accuracy and improved putting kinematics | 64% |
| 10 | Jetter and Walker (2015) | Tennis | Archival | N/S | 853 | Ability | Provides evidence for clutch ability effect in tennis | 69% |
| 11 | McEwan et al. (2012) | Golf | Between-subjects experimental | Self-focus | 119 | Episode | Participants in high-pressure warm up condition had better clutch performance than those in low-pressure warm up condition | 50% |
| 12 | Otten (2009) | Basketball | Between-subjects experimental | Self-focus | 243 | Episode | Perceived control was the strongest predictor of clutch free-throwing shooting performance | 71% |
| 13 | Otten and Barrett (2013) | Baseball | Archival | Self-focus | 2936 ^c | Ability | Mixed evidence of clutch performance. Regular and post-season performance were correlated; however, individuals and teams were capable of clutch (and choke) performances. | 72% |
| 14 | Ruane (2005) | Baseball | Archival | N/S | 727 | Ability | No evidence of clutch hitters | 44% |
| 15 | Solomonov et al. (2015) | Basketball | Archival | Self-focus & Distraction | 196 | Ability | Partial evidence for clutch ability; clutch players increase individual effort, however shooting accuracy remains unchanged | 74% |
| 16 | Wallace et al. (2013) | Basketball | Archival | N/S | 478 | Ability | No evidence of clutch shooters | 46% |
| 17 | Worthy et al. (2009) | Basketball | Archival | RFT | N/S | Ability | No evidence of clutch free-throw shooting; shooters generally choke | 38% |
| Qualitative | | | | | | | | |
| 18 | Hill and Hemmings (2015) | Golf | Career-based SSI | Self-presentation | 6 | Episode | Coping responses associated with clutch performances included pre- and post-shot routine, cognitive restructuring, simulated practice, acceptance, and withdrawal | 85% |

| | | | | | | | | |
|---------------|---------------------------|--------------------|---|--------------------------|-----------------|---------|---|-----|
| 19 | Hill et al. (2017) | Mixed ^a | Career-based SSI | Self-presentation | 9 | Episode | Proactive coping strategies, holding acquisitive-agentive beliefs, positive appraisal of anxiety, and perceived control were identified to precede and characterise clutch performances. | 85% |
| 20 | Maher et al. (2018) | Basketball | Career-based SSI | Self-focus & Distraction | 7 | Episode | Broad range of influencing variables, mental skills and management strategies facilitate performance under pressure | 56% |
| 21 | Swann et al. (2017a) | Mixed ^a | Event-focused SSI | IMFCS | 16 | Episode | Clutch states, reported to consist of 12 characteristics, appeared in a range of sports and exercise activities, across a range of expertise | 90% |
| 22 | Swann et al. (2017b) | Mixed ^a | Event-focused SSI | IMFCS | 26 | Episode | Clutch states occurred in contexts of importance, where an outcome is on the line. The occurrence of clutch states included challenge appraisal, setting specific goals, and a decision to increase effort | 90% |
| 23 | Swann et al. (2019) | Mixed ^b | Event-focused SSI | IMFCS | 18 | Episode | Suggest themes such as achievement, competition, and pressure, can occur outside of sport and provide a context for the occurrence and experience of clutch states in exercise | 85% |
| Mixed methods | | | | | | | | |
| 24 | Jackman et al. (2017) | Mixed ^a | Event-focused SSI; FSS-2; FQ | IMFCS | 10 | Episode | Most salient features distinguishing clutch states from flow included intense effort, heightened awareness, and deliberate focus. | 84% |
| 25 | Jackman et al. (in press) | Mixed ^a | Event-focused SSI; FSS-2; FQ; MTQ48 | IMFCS | 16 | Episode | Athletes high in mental toughness experience clutch states more frequently and sustain these longer than athletes low in mental toughness | 80% |
| 26 | Owens et al. (2016) | American Football | Career-based SSI; ProScan Survey | Distraction | 27 ^d | Ability | Coach identified clutch players more likely to have personalities high in dominance, low in pace, and low in conformity | 38% |
| 27 | Swann et al. (2016) | Golf | Event-focused SSI; Observations; Performance data | IMFCS | 10 | Episode | Clutch state reported to underlie excellent performance. Occurrence of clutch state included awareness of the situation, setting specific goals, and a challenge appraisal leading to increased concentration | 82% |

Note: ID: Identification number; QA: Quality appraisal score; ^aMixed sport; ^bMixed exercise; SSI: Semi-structured interviews; FSS-2: Flow State Scale-2 (Jackson & Eklund, 2002); FQ: Flow Questionnaire (Csikszentmihalyi & Larson, 1984); MTQ48: Mental Toughness Questionnaire-48 (Clough, Earle, & Sewell, 2002); N/S: Not specified; NET: Neoclassic economic theory; Self-focus: Self-focus theory; Distraction: Distraction theory; RFT: Regulatory focus theory; IMFCS: Integrated Model of Flow and Clutch States; Self-presentation: Self-presentation model; ^cTotal size of a mixed sample, including 835 pitchers, 1731 batters, and 370 teams, in which one individual may be in multiple categories; ^dThis included 1 coach (interviewed) and 26 players (surveyed)

two studies (Swann et al., 2017a, 2017b), whilst only participants in exercise were examined by Swann et al. (2019).

Quality appraisal

Table 1 also displays quality appraisal scores from the QATSDD (Sirriyeh et al., 2012) for the included studies. The mean quality appraisal score across all studies was 61%. Archival studies generally received the lowest quality scores, on account of lacking clear conceptual frameworks, not justifying sample sizes, and omitting discussion of strengths and weaknesses (a full score for each paper by category is found in Supplementary File 3). Experimental studies, meanwhile, ranged from scores of 50% (McEwan et al., 2012) to 71% (Otten, 2009). Qualitative and mixed method studies were generally the highest scoring and, with the exception of Owens et al. (2016; 38%) and Maher et al. (2018, p. 56%), all scored above 80% (see Table 1).

Research design

There were two distinct approaches to how research was designed to examine clutch performance. The most common approach ($n = 14$) was to examine clutch performance over a series of related performances. For example, studies measured clutch performance across multiple games (e.g. Solomonov et al., 2015), consecutive seasons (e.g. Birnbaum, 2008), or entire careers (e.g. Deane & Palmer, 2006). These were primarily archival studies, but also involved one mixed methods study (Owens et al., 2016; see Table 1). Hibbs (2010) has previously termed this approach 'clutch ability ... when one is notable for delivering clutch performances' (p. 48). Accordingly, we term this the *clutch ability* approach.

The other approach ($n = 13$) was to examine clutch performance in isolated episodes of performance. For example, studies investigated a single experimental session (e.g. Otten, 2009), an isolated performance (e.g. Swann et al., 2016), or a number of isolated performances, which were considered unrelated, from the same athlete (e.g. Jackman et al., 2017). Studies examining isolated performance episodes were experimental, qualitative, or mixed methods in design (see Table 1). We term this the *clutch episodes* approach. These two approaches represent different conceptual perspectives on clutch performance, and consequently, have implications for how it should be measured. As such, the remainder of this Results section will consider, where possible, these two approaches separately.

Defining clutch performance

Definitions of clutch performance from the included studies are provided in Table 2. An explicit definition of clutch performance (or related concepts, see *clutch ability*, *clutch situations*, and *clutch states*) was not provided in 26% ($n = 7$) of the studies. Clutch was defined in terms of a performance (i.e. a performance under pressure; Swann et al., 2017a), as an ability (i.e. the ability to produce repeated clutch performances; Deane & Palmer, 2006), a situation (i.e. a high pressure or critical game situation; McEwan et al., 2012), or a psychological state (i.e. the subjective experience underlying clutch performance; Swann et al., 2019). These different definitions are discussed below.

Table 2. Definitions of clutch in the included studies.

| ID | Definitions |
|----|---|
| 1 | Situation: 'For clutch, I used the Elias "Late Inning Pressure" definition – seventh inning or later, tied or down by 3 runs or less, unless bases are loaded, in which case down by 4 runs was included' (p. 75) |
| 2 | No explicit definition provided |
| 3 | Situation: 'the best clutch hitter as the man whose total batting average improved the most in late-inning pressure situations. (A late inning pressure situation is one occurring in the seventh inning or later, with the batter's team either tied to trailing by three runs or less, four runs if the bases are loaded)' (p. 1) |
| 4 | No explicit definition provided |
| 5 | No explicit definition provided |
| 6 | Ability: 'batters whose performance in critical game situations consistently exceeds expectations, as established by both that batter's performance in less critical situations and also by the relative performance of average batters in critical game situations' (p. 85); 'clutchness, a possible tendency for a hitter to be more effective in critical game situations' (p. 86) |
| 7 | Ability: 'clutch pitchers: men who won significantly more games than expected because of some unusual ability to pitch to the score and emerge victorious in the close games' (p.124) |
| 8 | No explicit definition provided |
| 9 | Performance: 'Superior performance that occurs under pressure circumstances (Otten, 2009)' (p. 392) |
| 10 | Ability: 'The clutch-player effect argues performance increases when stakes are higher' (p. 97) |
| 11 | Situation: 'instances of high pressure (or in "clutch" situations)' (p. 144) |
| 12 | Performance: 'we define a clutch performance here as any performance increment or superior performance that occurs under pressure circumstances' (p. 584) |
| 13 | Performance: [in reference to choking] 'Otten (2009) proposed that a "clutch" performance is a similar performance increment under pressure' (p. 532) |
| 14 | Situation: 'a clutch situation as an at-bat with runners in a scoring position' (p. 29) |
| 15 | Performance: 'The term "clutch" is commonly used to describe any performance increment or superior performance, relatively better than usual standards, that occurs under pressure circumstances (Albert, 2007; Otten, 2009). It often refers to high levels of performance in a critical situation, typically that of a game-deciding shot or the final few minutes in a close/tied match'(p. 130) |
| 16 | No explicit definition provided |
| 17 | No explicit definition provided |
| 18 | Performance: 'Otten's (2009) definition was adopted (i.e. "any superior performance under pressure" ...) ' (p. 525) |
| 19 | Performance: 'defined (at the start of the recruitment process) as a superior performance under pressure (Otten, 2009)' (p. 143) |
| 20 | Performance: [in reference to performing under pressure] 'adaptive (e.g. "clutch") responses' (p. 1) |
| 21 | Performance: 'clutch response has been defined as "any performance increment or superior performance that occurs under pressure circumstances" (Otten, 2009, p. 584). Moreover, a clutch performance occurs when an athlete succeeds during a pressure situation, is aware that the performance occurs during a pressure situation, has the capacity to experience stress, perceives the outcome of the competition as important and succeeds largely through effort (Hibbs, 2010). Therefore, clutch performance is about above-average performance in a competitive pressure situation, during which the athlete is aware of the pressure' (p. 2273) |
| 22 | Performance: 'clutch performance has been defined as "any performance increment or superior performance that occurs under pressure circumstances" (Otten, 2009, p. 584). Importantly, Hibbs (2010) proposed that the athlete must be aware of that pressure, have the capacity to experience stress, perceive the outcome of the competition as important, and succeed largely through effort' (p. 378) |
| 23 | Performance: 'refers to improved performance under pressure (Otten, 2009)' (p. 88) Psychological State: 'clutch states therefore appear to underlie such instances of superior performance under pressure (Otten, 2009), with Hibbs (2010) denoting that the athlete must be aware of that pressure; have the capacity to experience stress; must perceive the outcome to be important; and must succeed largely through effort' (p. 88) |
| 24 | Performance: 'defined as "any performance increment or superior performance that occurs under pressure circumstances" (Otten, 2009, p. 584). Furthermore, clutch performance represents instances when competitive athletes are successful in pressured situations, are cognisant of the pressure attached to the situation, possess a capacity to experience stress, understand the importance of the outcome and achieve their success through skilled actions (Hibbs, 2010)' (p. 114) Psychological State: 'clutch states refer to the subjective experience underlying clutch performance (Swann et al., 2017a)' (p. 114) |
| 25 | Performance: 'defined as "any performance increment or superior performance that occurs under pressure circumstances" (Otten, 2009, p. 584), and is considered to occur when an athlete is successful in a challenging and important situation, is aware of the situation's importance, can experience task-related stress, is concerned with the performance outcomes, and thrives through skill rather than good fortune (Hibbs, 2010)' (in press) |
| 26 | Ability: 'a clutch athlete exhibits superior performance under pressure (Otten, 2009)' (p. 4) |
| 27 | Performance: 'when an athlete is aware that they are performing in a challenging situation, cares about the outcome, has the capacity to experience stress about that situation, and succeeds primarily due to skill (see Hibbs, 2010 for full definition and conceptual analysis)' (p. 111) |

Clutch performance. The most common definition ($n = 10$) of clutch performance was Otten's (2009) definition. This definition was the first instance in the included literature that clutch was defined in terms of performance, rather than in terms of an ability or situation. It is unclear, however, whether Otten's (2009) definition strictly refers to a singular performance episode. For example, two studies (Otten & Barrett, 2013; Solomonov et al., 2015), which measured clutch performance over multiple performances, employed Otten's (2009) definition. Six studies referenced Hibbs (2010) definition of clutch performance. Of note, five of these studies also referenced Otten's (2009) definition. In these five studies, both definitions were viewed as complementary (i.e. used together – see Table 2), rather than compared or contrasted. Indeed, none of the included studies examined the implication of using different definitions of clutch performance on the same data (i.e. if using different definitions changed the findings). Lastly, Maher et al. (2018) defined clutch performance as 'adaptive (e.g. clutch) responses' (p. 1) to pressure. The definition employed by Maher et al. (2018) is considerably vague, and it is unclear how, or if, this definition fits with either Otten's (2009) or Hibbs (2010) definition of clutch performance.

Clutch ability, clutch situations, and clutch states. Clutch was defined as an ability in four studies. Two of these definitions were specific to baseball (Cramer & Palmer, 2008; Deane & Palmer, 2006), with the remaining definitions generalisable across sports (Jetter & Walker, 2015; Owens et al., 2016 – see Table 2). Interestingly, Owens et al. (2016) cited Otten's (2009) definition, but clearly positioned clutch as an ability (i.e. 'a clutch athlete exhibits superior performance under pressure'; Owens et al., 2016, p. 4). As above, it is unclear whether Otten's (2009) definition is episodic or can apply to studies examining clutch ability.

A definition of a clutch situation was provided in four studies. Baseball-specific definitions were provided in three of these studies (Birnbaum, 2008; Brooks, 1989; Ruane, 2005), whilst one study provided the broad definition of a clutch situation as 'instances of high pressure' (McEwan et al., 2012, p. 144). Clutch states, meanwhile, were defined as the psychological state underlying clutch performances (Jackman et al., 2017; Swann et al., 2017b). Whilst both Jackman et al. (2017) and Swann et al. (2017b) also provided definitions of clutch performance, it is unclear if clutch states and clutch performance are two distinct constructs, or if they are interconnected (i.e. if the experience of clutch states is an inherent aspect of clutch performance, and vice versa).

Comment. To date, various approaches to examining and defining clutch performance have been employed in the literature. It is therefore important that consistent terminology is used for the remainder of the Results. Accordingly, *clutch performance* will be used as an umbrella term, incorporating both clutch ability (i.e. clutch performance over a series of related performances) and clutch episodes (i.e. clutch performance as an isolated performance episode). Where possible, the more specific terminology of either clutch ability or clutch episodes will be used.

Theoretical frameworks and clutch performance

Table 1 provides an overview of the theoretical frameworks and conceptual models within the included studies. From the included studies, 33% ($n = 9$) provided no explicit theoretical framework for clutch performance. These studies may therefore be considered

atheoretical. The following section discusses the different theoretical frameworks that were employed in the remaining studies.

Choking-based explanations. Eleven studies examined clutch performance in relation to choking. Primarily, these studies drew on attentional theories ($n = 8$), which included self-focus theories ($n = 5$), distraction theories ($n = 1$), or both self-focus and distraction theories ($n = 2$). Of note, the majority ($n = 5$) of studies utilising attentional theories employed definitions that called for increased performance (e.g. Otten, 2009). No explanation was provided, however, for how such theories accounted for increased performance (i.e. only the proposed mechanisms behind performance breakdown were described). One study (Worthy et al., 2009), meanwhile, drew on regulatory focus theory. This theory explains that athletes are more likely to experience performance decrements when trying to avoid losing the game, as opposed to when trying to win the game. Lastly, Hill and Hemmings (2015) and Hill et al. (2017) examined the self-presentation model. The self-presentation model is concerned with understanding how one's self-presentation motives affect their performance anxiety, which may then precede attentional breakdowns via self-focus or distraction.

Integrated Model of Flow and Clutch States. Six studies (Jackman et al., 2017; in press; Swann et al., 2016, 2017a, 2017b, 2019) positioned clutch states within the Integrated Model of Flow and Clutch States. This model outlines the performance contexts, process of occurrence (discussed further below), subjective experience, and outcomes of clutch states. Hence, this model focuses on explaining the psychological state underlying clutch performance, rather than clutch performance per se (see *Inadequate Theoretical Framework* for further discussion).

Neoclassic economic theory. One study (Cao et al., 2011) stated that 'neoclassical economic theory predicts that individuals exert the most effort, and consequently produce their best performances, when the returns to effort are highest' (p. 231). Little further information, however, was provided about this theory, and how the results may or may not support it.

Measurement of clutch performance

No established measure of clutch performance was utilised in the included studies. Accordingly, this section reviews approaches to measurement with respect to the two essential constructs of clutch performance (i.e. those constructs that are core across definitions of clutch performance): (i) performance; and, (ii) pressure.

Measuring performance. Naturally, performance is inherent in the study of clutch performance. The following section addresses approaches to measurement of performance in studies examining clutch ability, and in studies examining clutch episodes.

Clutch ability. Table 3 presents the ways in which performance was assessed in the included studies. Objective measures of performance were employed in the majority of studies assessing clutch ability ($n = 13$; 94%). These studies all examined archival, naturalistic performance data. The benchmarks against which performance was assessed ranged considerably, however, and included comparing performance against: career averages (Cao et al., 2011); previous season performance (e.g. Birnbaum, 2008); performance within the same season (e.g. Birnbaum, 2009); and, performance within the same game (e.g. Wallace et al., 2013). In one study performance was assessed against an athlete's

Table 3. Measurement of performance.

| Design | Measurement of Performance | Analysis | Studies | |
|-----------------|----------------------------|---|---|---------------------------------------|
| | | | Sport-specific skill performance ^a | Global sport performance ^b |
| Clutch ability | Objective Archival | Relative to previous season performance | | 1, 3, 5 |
| | | Relative to same season performance | | 2, 13 |
| | | Relative to projected performance | | 7 |
| | | Relative to career average performance | 4, 17 | 6, 10, 14 |
| | | Relative to same game performance | | 16 |
| | | Relative to same game performance and teammates same game performance | | 15 |
| | | Coach-reported | | 26 |
| Clutch episodes | Subjective | | | |
| | Objective | | | |
| | Mixed methods | Observation – relative to tournament performance | | 27 |
| | Experimental | Relative to baseline performance | 8, 9, 11, 12 | |
| | Subjective | Self-reported | | 18, 19, 20, 21, 22, 23, 24, 25, 27 |

^aRefers to specific skills within sports, specifically golf-putting and basketball free throw shooting.
^bRefers to general sport performance.

projected performance (i.e. clutch ability was judged against performances that had not yet occurred; Deane & Palmer, 2006). Across all of these studies, performance was considered to have improved if there was a statistically significant increase compared to the respective performance benchmark (e.g. one’s career average; Cao et al., 2011). Subjective measurement of performance, meanwhile, was adopted in one mixed methods study (Owens et al., 2016). In this study, performance was assessed by asking a coach to evaluate which players in their team consistently performed well, or did not perform well, under pressure.

Clutch episodes. As displayed in Table 3, studies in which clutch performance was assessed as an isolated episode primarily measured performance using subjective methods ($n = 8$; 62%). Generally, measurement involved participant self-report through semi-structured interviews, which principally reported athletes’ and exercisers’ perceptions of their own performance.

All experimental studies utilised objective measures of performance ($n = 4$; 31%). Performance was assessed following pressure manipulation in a sport-specific task (i.e. golf-putting, $n = 3$; basketball free-throw shooting, $n = 1$), and then compared with baseline scores. In three studies (Gray et al., 2013; Otten, 2009; McEwan et al., 2012), performance improvement following pressure manipulation was considered clutch performance. As in the archival designs, performance was considered to have improved if there was a statistically significant increase compared to baseline performance. One study (Gray & Cañal-Bruland, 2015) meanwhile, considered clutch performance to be evident in those participants who did not choke. Accordingly, the clutch performance group in this study still decreased performance relative to baseline, but to a significantly lesser degree than

those who choked. This suggests confusion around the extent of the performance increment required to classify a clutch performance.

One study (Swann et al., 2016) utilised both objective and subjective measures of performance. Specifically, this study involved observations of professional golfers during the final rounds of tournaments, a performance monitoring tool to objectively 'indicate peaks and troughs in the player's performance' (p. 104), and then event-focused interviews about the same rounds as soon as possible afterwards. To date, this appears to be the only study that has combined both objective and subjective measurement of performance.

Measuring pressure. The construct of pressure is central to definitions of clutch performance. Pressure is 'the presence of situational incentives for optimal, maximal, or superior performance' (Baumeister & Showers, 1986, p. 362), and importantly, involves a subjective component. The following sections review approaches to measurement of pressure in studies investigating clutch ability, and studies investigating clutch episodes.

Clutch ability. Table 4 provides an overview of the methods used to measure pressure in the included studies. The majority of studies ($n = 13$; 94%) designed to measure clutch ability did not directly measure pressure. Instead, as a proxy measure, certain in-game situations were used to represent pressure. Across these 13 studies, eight different situations were specified to infer pressure (see Table 4). Generally, these were situations considered

Table 4. Measurement of pressure.

| Design | Direct Measurement of Pressure? | Methods | Measurement | Studies |
|------------------------|---|--|---|------------|
| Clutch ability | NO | Proxy/Secondary | Operationalisation | |
| | | | Probabilistic importance ^a | 5, 6 |
| | | | LIP situation ^b | 1, 3 |
| | | | Personal goal ^c | 2 |
| | | | With runners in scoring position ^d | 14 |
| | | | Context of tournament or game | 10, 13 |
| | | | Time remaining and score differential | 4 |
| | | | Context of game and time remaining | 16 |
| | | | Context of game, time remaining, and score differential | 15, 17 |
| | | No explicit operationalisation of pressure situation | | 7 |
| Clutch episodes | YES | Self-report (quant.) | ProScan Survey | 26 |
| | | Coach-report (qual.) | Interview with coach | 26 |
| | | YES | Self-report (qual. and mixed methods) | Interviews |
| Anecdotal ^e | 11 | | | |
| Self-report (quant.) | Immediate Anxiety Measures Scale (IAMS) | | 8, 9 | |
| | Competitive State Anxiety Inventory-2 (Revised) (CSAI-2R) | | 12 | |
| | Physiological | | Heart rate | 8 |

^aIncludes formulas which account for the importance of certain match points on the overall outcome of the match, where more important points represent higher pressure, and are more heavily weighed.

^bLIP situation is defined as 'seventh inning or later, tied or down by 3 runs or less, unless the bases are loaded, in which case down by 4 runs is included'.

^cGoing for a 20th win when pitching in baseball.

^dWhen batting in baseball and runners are in a position to score.

^eResearchers asked participants how much pressure they felt after the experiment, but this was not analysed or reported.

important to the overall outcome of the game or tournament, although there was some inconsistency. For example, Solomonov et al. (2015) considered pressure in the NBA as the last five minutes in games within a score differential of 6-points, in the last 20 games of the regular season. Worthy et al. (2009), meanwhile, considered pressure as the last minute in games within a score differential of 5-points, in NBA playoff games. Taken together, the decisions to determine what situations and factors represent pressure seem rather inconsistent and arbitrary. Indeed, only one study (Otten & Barrett, 2013) provided supporting justification that the assessed situation – MLB playoff games – was likely to increase an athletes' pressure. Specifically, Otten and Barrett (2013) noted that greater fan attendance, media attention, and internal and external rewards were likely to increase traditional forms of pressure (e.g. presence of audience, ego relevance, reward contingency; Baumeister & Showers, 1986).

The remaining study that examined clutch ability utilised a mixed methods design. Owens et al. (2016) conducted a single coach interview, which involved the coach identifying which players performed well under pressure. In addition, Owens et al. (2016) also distributed a ProScan Survey (Professional Dynamic Programs, 2003) to athletes, who were instructed to reflect on how they expect to perform under pressure. The ProScan Survey has been validated as a measure of personality (Hubby & Williamson, 1988), though not as a measure of pressure. In summary, it is difficult to discern the extent to which the operationalisation and measurement of pressure was valid across studies examining clutch ability.

Clutch episodes. Studies designed to examine clutch episodes used a range of methods and tools to measure pressure (see Table 4). Qualitative and mixed methods approaches predominantly involved interviewing athletes and exercisers ($n = 9$). Interview methods allow for rich and detailed descriptions of subjective experiences (Smith & Sparkes, 2019), and hence, could offer a valuable avenue for in-depth explorations of pressure.

Experimental studies ($n = 4$) primarily employed psychometric measures of anxiety to examine pressure. Gray et al. (2013) asked participants to respond to the Immediate Anxiety Measures Scale (IAMS; Thomas et al., 2002). Similarly, Gray and Cañal-Bruland (2015) used the cognitive and somatic anxiety items of the IAMS, which has been identified as a valid and reliable measure of anxiety (Thomas et al., 2002), whilst also assessing changes in participants' average heart rate between trials. Meanwhile, Otten (2009) employed the Competitive State Anxiety Inventory 2 (Revised) (CSAI-2R; Cox et al., 2003), which is also a validated measure of anxiety (Cox et al., 2003). Whilst anxiety has been identified as an indicator of pressure (e.g. Gucciardi & Dimmock, 2008), measures of anxiety do not directly measure perceptions of pressure (Kent et al., 2018). As such, it is arguably the case that these experimental studies did not actually measure pressure, but examined a single, negatively framed (e.g. Burton & Naylor, 1997), indicator of pressure. Lastly, McEwan et al. (2012) asked participants 'how much pressure and anxiety they felt throughout the experiment' (p. 145). Responses to this question, however, did not undergo formal qualitative analysis, and accordingly were not reported in the results. Hence, the validity of this pressure manipulation is unclear.

Evidence for clutch performance

Evidence for clutch performance as an observable phenomenon was mixed. This section reviews the evidence for clutch performance with respect to studies that examined clutch ability, and studies that examined clutch episodes.

Clutch ability. Ten studies explicitly investigated the existence of clutch ability in sport.⁶ From these studies, eight did not provide support for the existence of clutch ability. In studies examining baseball, fluctuations in performance during pressure situations were demonstrated to be more likely a product of random variation (Brooks, 1989; Cramer & Palmer, 2008; Deane & Palmer, 2006; Ruane, 2005), general hitting quantity (Cramer, 1977), or in the case of pitching, other performance factors (e.g. run support; Birnbaum, 2009). Further, clutch performance in one season was not predictive of clutch performance in future seasons (Birnbaum, 2008). In basketball, meanwhile, Wallace et al. (2013) demonstrated that most players were statistically average during the 4th quarter of NBA playoff games when compared with the previous 3 quarters of the same game, indicating no evidence of clutch ability.

In contrast, Jetter and Walker (2015) demonstrated support for the existence of clutch ability in tennis. Higher ranked players were more likely to win a Grand Slam tournament relative to other events, and also more likely to perform well in clutch situations within the match (e.g. tie-breaks). Furthermore, Solomonov et al. (2015) showed that 'clutch players' performance generally improves in the sense that they exert more effort in the final, critical moments of the game' (p. 136). Metrics such as foul drawing, free throw attempts, and successful free throws significantly increased compared to earlier periods in the game. These findings raise questions as to what aspects of performance must increase to be considered a clutch performance. For example, is increased effort, or specific components of performance – such as fouls drawn – sufficient, or is a more global perspective of performance outcomes necessary for clutch performance? In summary, there was limited support for the existence of clutch performance when examined as an ability. The measurement limitations of these studies, however, should be considered when assessing the validity of this conclusion. Specifically, it is unclear to what extent pressure was experienced by athletes in these studies, and the performance benchmarks used to assess performance were inconsistent.

Clutch episodes. In contrast to studies examining clutch ability, studies investigating isolated clutch episodes demonstrated strong support for the existence of clutch performance. Experimental studies generally indicated that participants could increase performance in response to pressure manipulations (Gray et al., 2013; Otten, 2009; McEwan et al., 2012). Qualitative studies showed that athletes could recall having clutch performances (Hill et al., 2017; Hill & Hemmings, 2015; Maher et al., 2018), whilst at the experiential level, clutch states – the subjective experience of clutch performance – were reported to occur during excellent sport performances and rewarding exercise experiences (e.g. Jackman et al., 2017). Specifically, clutch states were proposed to consist of 12 characteristics: absence of negative thoughts; absorption; altered sensory perceptions; automaticity of skills; confidence; deliberate focus; enhanced motivation; enjoyment; heightened arousal; heightened awareness; intense effort; and perceived control (Jackman et al., 2017, in press; Swann et al., 2016, 2017a, 2017b, 2019). In summary, support for clutch performance both as a performance outcome, (e.g. Gray et al., 2013) and at an experiential level (e.g. Swann et al., 2017a), was demonstrated in studies examining clutch episodes.

Occurrence of clutch performance

This section reviews factors involved in the occurrence of clutch performances. Given that limited supporting evidence was found for clutch ability, this section focuses solely on the occurrence of clutch episodes.

Clutch episodes. From experimental studies, a range of factors were identified in the occurrence of clutch performance. Gray et al. (2013) demonstrated that in golf putting, participants who increased performance under pressure had improved putting kinematics (i.e. swing amplitude) compared to baseline performance. McEwan et al. (2012), meanwhile, showed that participants who warmed up under high-pressure conditions performed significantly better in a single-shot, golf-putting task than those who warmed up under low-pressure conditions. Lastly, Otten (2009) indicated that a sense of perceived control during a free-throw task was the strongest predictor of clutch performance. The factors identified in the occurrence of clutch performance, therefore, varied considerably across experimental designs, and included technique improvements, warm-up strategies, and psychological mechanisms.

The occurrence of clutch performance episodes was also investigated in qualitative designs. Hill and Hemmings (2015) reported a number of approach coping strategies to facilitate clutch performance, such as simulated practice, performance routines, and cognitive restructuring (e.g. re-appraising threatening stressors as a challenge). The roles of simulated practice and performance routines in the occurrence of clutch performance were also highlighted by Maher et al. (2018) and Hill et al. (2017), in addition to a range of other factors. For example, Hill et al. (2017) reported that a sense of perceived control and challenge appraisal were also involved in the occurrence of clutch performances. Collectively, factors that consistently emerged out of these qualitative studies were challenge appraisal, simulated practice, and performance routines.

Four studies reported the occurrence of clutch states as a series of steps (Jackman et al., *in press*; Swann et al., 2016, 2017b, 2019). Clutch states occurred in contexts characterised by importance, and when the participant was still in contention to achieve an important goal. Athletes and exercisers initially appraised the situation as a challenge before setting specific goals relating to the desired outcome of that situation. Athletes and exercisers then made a deliberate decision to 'step up' their effort and intensity in order to try and achieve those goals (Swann et al., 2019, p. 92). In addition, Jackman et al. (*in press*) reported that the occurrence of clutch states occur may be related to an athlete's mental toughness. Specifically, athletes high in mental toughness reported a more rapid initiation of clutch states than athletes low in mental toughness, particularly when in response to setbacks. Whilst processes of occurrence for clutch states has been consistently reported (Jackman et al., *in press*; Swann et al., 2016, 2017b, 2019), questions remain over the relationship between clutch states and clutch performance (i.e. do clutch states always underlie clutch performances?).

Discussion and recommendations

The aim of this review was to synthesise and evaluate existing research on clutch performance in sport and exercise. The findings indicated that research into clutch performance has gathered momentum in the last decade. Over 75% ($n = 21$) of the included studies

were published since 2009, with a third ($n = 9$) published since 2016. This momentum suggests that clutch performance is a contemporary field of research in sport and exercise psychology (e.g. Perry, 2019). Findings from this review, however, also suggest there is significant definitional, conceptual, and measurement heterogeneity within the field. Clutch performance has been defined inconsistently, with definitions referring to this construct both as an ability and an individual performance, whilst studies have also employed definitions of clutch situations and clutch states. Accordingly, two major approaches are evident in the field, which conceptualise clutch performance as an: (i) ability; and (ii) individual performance episode. These differing approaches have resulted in disparate measurement of clutch performance with questionable validity, and consequently, conflicting evidence regarding the existence of clutch performance.

Assessing evidence for clutch performance

Studies which explicitly investigated the existence of clutch ability ($n = 10$) demonstrated limited support. As Hibbs (2010) noted, however, 'in order to assign clutch ability to a competitor, one must first know what a clutch performance is' (p. 48). At present, definitions of clutch performance lack specificity and clarity (see *Definitional Issues*), and consequently, it is difficult to determine exactly what clutch ability is. Moreover, studies examining the existence of clutch ability relied on proxy measures of pressure (i.e. certain game situations were used to infer pressure), meaning that the extent to which these athletes experienced pressure is unclear. Against this backdrop of definitional and measurement issues, making any conclusions about the existence of clutch ability based on current literature seems somewhat premature.

In contrast, support for isolated episodes of clutch performance was demonstrated across qualitative, experimental, and mixed methods designs. These studies identified a variety of factors in the occurrence of clutch performance. For example, technique improvements (e.g. Gray et al., 2013), simulated practice and performance routines (e.g. Maher et al., 2018), and psychological processes (e.g. perceived control; Otten, 2009) were all identified in the occurrence of clutch performance. In addition, Swann et al. (2016, 2017b, 2019) and Jackman et al. (in press) highlighted a sequential process in the occurrence of clutch states. Whilst these studies provide evidence for isolated episodes of clutch performance, they also highlight inconsistencies in how the occurrence of clutch performance has been examined, ranging from exploration of distal factors (e.g. simulated practice; Maher et al., 2018) to more proximal factors (e.g. perceived control; Otten, 2009). This perhaps suggests that even within studies adopting a similar approach (i.e. clutch episodes), there remains some confusion over how to examine the occurrence of clutch performance.

Definitional issues

Definitions are important in facilitating conceptual clarity, informing measurement, and determining the direction of future research (Cooper et al., 2001; Wacker, 2004). This review demonstrated that 26% ($n = 7$) of studies did not provide a definition of clutch, in any sense. When definitions were provided, these extended beyond defining clutch performance, and were also provided in terms of an ability (i.e. the ability to produce

repeated, increased performances during critical game situations; Deane & Palmer, 2006), a situation (i.e. performance situation which is high in pressure; McEwan et al., 2012), and as a psychological state (i.e. the subjective experience underlying clutch performance; Swann et al., 2019). These varied definitions suggest conceptual confusion surrounding what clutch performance is, and is not. The most common definitions of clutch performance, meanwhile, were applied inconsistently. Otten's (2009) definition of clutch performance was cited both in studies that examined clutch performance as an ability (e.g. Solomonov et al., 2015), and as an individual episode (e.g. Hill et al., 2017). Further, five studies supplemented Otten's (2009) definition with Hibbs (2010) definition of clutch performance, despite there being meaningful differences between the two (see *Guiding Principles for Clutch Performance Research*). Hence, a key finding from this review is that current definitions of clutch performance have not facilitated conceptual clarity and, accordingly, may require refinement to clearly differentiate between clutch ability and clutch performance episodes.

Inadequate theoretical framework

Robust theory represents a fundamental aim of science, providing the foundation upon which research and practice should be built (Cunningham, 2013; Doherty, 2013). The present review indicated that current theoretical approaches to clutch performance are insufficient. The most popular approach ($n = 11$) within the included studies was to employ theories (i.e. attentional theories) and models (i.e. self-presentation model) that primarily focused on explaining the mechanisms underlying performance breakdown. Both attentional theories and the self-presentation model, however, are grounded in performance responses to anxiety. Whilst anxiety is an indicator of pressure (e.g. Gucciardi & Dimmock, 2008), it has not been demonstrated that experiencing pressure always results in anxiety. Indeed, Baumeister and Showers's (1986) formative, and widely used (e.g. Low et al., 2020), definition of pressure is relatively neutral (i.e. 'the presence of situational incentives for optimal, maximal, or superior performance', p. 362). As such, it may not be the case that all clutch performances are preceded by symptoms of anxiety or occur in a state of anxiety. Therefore, based on current understandings of clutch performance, attentional theories and the self-presentation model do not account for the range of potential responses to pressure that may lead to clutch performance.

The Integrated Model of Flow and Clutch States (Swann et al., 2017b, 2019) was employed in six studies, and describes the occurrence and experience of clutch states. Whilst this model emerged from a primarily qualitative methodology based on inductive analysis, and is yet to undergo harsher tests (e.g. experimental designs), it does outline a process of occurrence for clutch states. Importantly, these predictions can be tested and, if unsupported, falsified. It remains unclear, however, if clutch states are inherent to clutch performance, and vice versa. As with attentional theories and the self-presentation model, the Integrated Model of Flow and Clutch States (Swann et al., 2017b, 2019) only provides a partial explanation of clutch performance (i.e. based on clutch states). Lastly, a third of the included studies ($n = 9$) employed no theoretical framework for clutch performance. This both limits the utility of these studies (i.e. cannot adequately explain and predict phenomena; Bacharach, 1989), and highlights that a notable quantity of clutch performance research has been atheoretical. In summary, current theories and conceptual

models do not offer complete explanations of clutch performance. Future research, therefore, needs to work towards development of a specific theory of clutch performance.

Methodological critique

Broadly defined constructs lacking in specificity and clarity may result in disparate measurement (Wacker, 2004). The impact of unclear definitions of clutch performance is evident in the extent to which measurement has been approached inconsistently. Clutch performance was examined as an ability in just over half of the included studies, which primarily involved utilising archival designs. Measurement of performance in archival designs ranged from comparing performance within the same game (e.g. Wallace et al., 2013) to comparing performance with a career average (e.g. Cao et al., 2011), highlighting the unclear nature of what benchmark clutch performance should be compared against. Further, archival studies did not directly measure pressure. Instead, pressure was treated as a categorical variable that was inferred from the performance situation (i.e. it was assumed all athletes experienced the same amount of pressure in certain situations, such as all games within a Grand Slam tournament; Jetter & Walker, 2015). Indeed, only one study (Otten & Barrett, 2013) justified why the performance situation (i.e. MLB playoffs) inferred pressure. This general lack of measuring pressure is problematic as pressure involves a subjective component (Baumeister & Showers, 1986) and, therefore, it cannot be assumed that all athletes will perceive these situations in the same way.

The impact of unclear definitions was also evident in experimental studies that examined clutch performance as an isolated episode. For example, different performance thresholds were used to categorise clutch performances between experiments (e.g. Gray & Cañal-Bruland, 2015). This suggests a need for consensus over the performance level required for clutch performance (i.e. increased or maintained performance). Furthermore, the use of psychometric measures of anxiety to assess pressure is incomplete. Whilst measurement of anxiety may indicate the intensity of cognitive and somatic anxiety, this provides little information regarding how, or if, pressure is interpreted facilitatively. Indeed, it is not clear whether the perception of pressure necessarily results in increased anxiety. Accordingly, more complete measurement of pressure is important, especially when considering questions have been raised about the capability of experimental designs to replicate the demands of naturalistic pressure situations (Gucciardi & Dimmock, 2008; Jackson, 2013).

From the included studies, qualitative and mixed method approaches represent the most appropriate measure of pressure at present. This is because interviews allow an in-depth exploration of pressure following real-world episodes of clutch performance. These interview methods, however, differed in their methodological strength. Specifically, three studies (Hill et al., 2017; Hill & Hemmings, 2015; Maher et al., 2018) employed career-based interviews, which ask athletes to report on events that occurred months or years in the past (Swann et al., 2018). In contrast, event-focused interviews aim to interview athletes within hours or days of a performance and have been suggested as a methodologically stronger alternative (Swann et al., 2018). This is because event-focused interviews may reduce the risk of athletes' forgetting details or presenting a biased recall (Brewer et al., 1991; Yarrow et al., 1970). Accordingly, studies that employ single event-focused interviews (Jackman et al., *in press*; Swann et al., 2017b, 2017a, 2019, 2016) may offer

the most detailed and accurate qualitative account of episodes of clutch performance. Studies that adopted repeat event-focused interviews with the same individual (e.g. Jackman et al., 2017), meanwhile, can provide insight into the consistent features underlying clutch performance, and how these features may develop or diminish over time.

Guiding principles for clutch performance research

Findings from the current review indicate that there are significant definitional, theoretical, and measurement issues within the field of clutch performance. These issues centre on a lack of consensus surrounding what clutch performance is, and what it is not. As a starting point in addressing these problems, we outline a number of recommendations in an effort to facilitate greater conceptual clarity. Specifically, we draw on the findings of this review to propose a number of guiding principles for future research on clutch performance.

First, clutch performance inherently requires pressure, which means that clutch performance is a psychological construct. Pressure involves the presence of situational incentives for optimal performance, and crucially, involves a subjective component (i.e. the situation is internally appraised as important; Baumeister, 1984). Accordingly, clutch performance cannot solely be measured as a behavioural outcome (such as runs scored; Deane & Palmer, 2006), as this method cannot account for subjective appraisal of situational importance. Measurement of pressure, therefore, is required when examining clutch performance, and future research should investigate if, and through what mechanisms, pressure may lead to increased performance.

Second, clutch performance is an isolated episode of performance – not an ability. Baumeister and Showers (1986) noted that ‘pressure by definition focuses on a single, present performance’ (p. 362). As discussed above, pressure is a requirement of clutch performance, and hence clutch performance must be an isolated episode. Further, the current review showed strong support for clutch performance as an isolated performance episode, whilst evidence for clutch performance as an ability was limited. Indeed, any examination of clutch ability inherently relies on first understanding singular episodes of clutch performance (Hibbs, 2010). Accordingly, research should examine clutch performance as an isolated performance episode, with a focus on understanding the requirements and boundaries of such an episode, before investigating the notion of clutch ability.

Third, positive performance is required for clutch performance. Otten (2009) defines clutch performance as ‘any performance increment or superior performance’ (p. 584), whilst Hibbs (2010) specifies a ‘successful performance’ (p. 49). Whilst the current review demonstrated support for both of these positions (Gray et al., 2013; Swann et al., 2017b), several questions remain. For example, when considering increased or superior performance, it is unclear what magnitude performance needs to increase by, and what benchmark the performance is compared against. It is also unclear as to what is required to constitute performance (e.g. is increased effort, or particular components of performance, sufficient?). Using ‘successful performance’, meanwhile, raises concerns over the extent to which clutch performance conceptually overlaps with constructs such as coping and choking-resistance (Kaiseler et al., 2009; Mesagno & Marchant, 2013). Therefore, at this stage, it is difficult to recommend the position of either Otten (2009) or Hibbs (2010). Accordingly, we recommend that researchers investigate positive performance under pressure. The intentions behind proposing the term *positive* are twofold.

Firstly, it acts as an umbrella term that encapsulates both increased, and successful, performance. Secondly, investigating a broad range of performances is important in bringing clarity to the questions raised above. For example, one line of inquiry for future research may be examining what performance thresholds athletes and exercisers utilise to evaluate their own performance under pressure. As such, this principle is proposed with the intention to be tested, challenged and refined through future research.

Last, the role of perceived (i.e. positively appraised) performance should be considered when evaluating clutch performance. The current review included a significant body of literature that primarily reported on perceived performance (e.g. Swann et al., 2019), in addition to studies that examined objective performance (e.g. Gray et al., 2013). Indeed, neither Otten's (2009) nor Hibbs (2010) definitions specify a distinction between perceived or objective performance. As such, it is recommended future research examines both objective and positively appraised performance. This principle should be adopted with an emphasis on understanding how athletes and exercisers judge their own performance. That is, do athletes and exercisers primarily rely on objective performance or perceived performance, or a combination of both, when evaluating their own performance under pressure.

The four guiding principles outlined above are provided as a tentative solution (Popper, 1981), and accordingly, are open to refutation. Indeed, these recommendations are proposed with the aim to stimulate further debate around what constitutes clutch performance and help guide future research. In summary, we recommend that researchers and practitioners be critical in adopting existing definitions of clutch performance and aim to develop a refined definition and theory of clutch performance.

Strengths and limitations

The systematic nature of the review was a strength. Efforts were taken to ensure transparency, limit author bias, and improve trustworthiness. Despite these strengths, there are also several limitations of the current review that are important to note. Firstly, this review excluded studies that were not in English or not in a peer reviewed journal, which may have created a language and publication bias. Secondly, the focus on participants in sports and exercise meant that related performance domains that may have investigated clutch performance were excluded. Third, to ensure that clutch was a primary focus of the study, the term clutch was only searched for in the title, abstract, and keyword field. Indeed, this may partly explain the relatively low return of 27 studies that were included in the present review, despite facilitation of performance under pressure being a fundamental aim of sport and exercise psychology. We recognise that studies in overlapping fields may not use the terminology of clutch performance, but rather more generic terminology (e.g. performance under pressure). However, to avoid the confounding of multiple concepts, and to limit the amount of irrelevant studies in the screening process, the focus of the present review was solely on the concept of clutch performance. Whilst the limitations of this review are recognised, at all stages steps were taken to limit these, whilst some were also inherent to the nature of the review question (e.g. a focus on sport and exercise).

Conclusion

The concept of clutch performance has experienced a substantial increase in research attention and activity over the last decade. This review demonstrated, however, that there are significant definitional, conceptual, and measurement issues within the field. Specifically, there appears to be a lack of clarity regarding what clutch performance is, and what clutch performance is not. In response, four guiding principles were provided as a tentative solution (Popper, 1981). In putting forth these principles, we seek to open debate around the concept of clutch performance in an effort to move the field forward. Indeed, definitional and conceptual refinement is essential to facilitate appropriate measurement of clutch performance, and in turn, move the field closer to its' overarching aim: to help individuals perform positively under pressure.

Notes

1. 'An activity involving physical exertion, skill and/or hand-eye coordination as the primary focus of the activity, with elements of competition where rules and patterns of behaviour governing the activity exist formally through organizations; and may be participated in either individually or as a team' (WHO, 2018, p. 101).
2. 'A subcategory of physical activity that is planned, structured, repetitive, and purposive, in the sense that the improvement or maintenance of one or more components of physical fitness is the objective' (WHO, 2018, p. 98).
3. To ensure the most appropriate tool was selected, three appraisal tools were piloted with five of the included papers, which were of a diverse methodology. These were the QATSDD (Sirriyeh et al., 2012), Mixed Methods Appraisal Tool (Pluye et al., 2011), and the QualSyst (Kmet et al., 2004). Following piloting, the QATSDD (Sirriyeh et al., 2012) was considered the most appropriate tool for the present review.
4. Career-based interviews seek general understanding of a phenomenon over an athlete's career or significant period of time (Swann et al., 2018). Event-focused interviews collect data soon after one specific event (e.g., within hours/days), which allows for more detailed and chronological recall of the event (Swann et al., 2018).
5. The sample size from Otten and Barrett (2013) was not included in this calculation, as it was unclear how many athletes appeared more than once (e.g., as pitching, batting, and team statistics were calculated for multiple seasons, meaning the same athlete may have been observed more than once).
6. Not all studies designed to examine clutch ability explicitly investigated whether the concept existed. Rather, four studies (Otten & Barrett, 2013; Cao et al., 2011; Owens et al., 2016; Worthy et al., 2009) assumed *a priori* that clutch performance, or clutch ability, existed.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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