

Job Characteristics of National Collegiate Athletic Association Strength and Conditioning Coaches: A Systematic Review

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ABSTRACT

This systematic review investigated the job characteristics of National Collegiate Athletic Association (NCAA) strength and conditioning coaches (SCCs). Three databases were searched (Web of Science, EBSCO, and PubMed) until 12th January 2023. Eligible studies had to meet four criteria: (a) written in English, (b) published in a peer-reviewed journal, as a report on an official website, or a master/doctoral dissertation, (c) reported the demographic and job information of NCAA SCCs, and (d) complete data for at least one common question across two studies were available. Fifteen studies (n = 2,455 SCCs) were included. All studies adopted similar survey designs and questions, providing a basis for comparison. The results of this systematic review reveal that from 1989–2022, the age, race, and gender characteristics of SCCs were similar, lacking diversity, but academic degrees, majors, certifications, job titles, and salaries differed. This study provides valuable information for those looking to work in the NCAA as SCCs or those with existing roles to develop into more senior positions. Furthermore, This study will support employers in creating more informed job descriptors and employment strategies. Finally, based on our findings we propose a consolidated survey based on prior research to enable continuous and longitudinal investigations of SCCs working in NCAA sports.

Keywords: college, survey, sports performance, workforce, demographics.

INTRODUCTION

The job role ‘strength and conditioning coach’ (SCC) originated in the United States of America (USA) at the University of Nebraska in 1969, with Boyd Epley thought to be the first full-time SCC [1]. Driven by Boyd Epley, the National Strength Coaches Association was founded in 1978 and renamed the National Strength and Conditioning Association (NSCA) in 1981, formally developing the role of SCC. By 1986, many colleges recruited SCCs, with the role becoming commonplace across different levels and sports [2]. A SCC is an individual who works with athletes to develop physical qualities (e.g., strength, speed, and aerobic capacity), optimize sports performance, improve recovery, and reduce general and sport-specific injuries [3]. Accordingly, SCCs are considered integral to the multidisciplinary athlete support team [4].

The National Collegiate Athletic Association (NCAA), founded in 1906, is a voluntary association of more than 1,100 universities and colleges in the USA and Canada. The NCAA includes Divisions I, II, and III, with Division I further divided into 1–A, 1–AA, and 1–AAA. Athletes in Division I universities are considered part of an elite pathway/program, whereas lower

Divisions typically have fewer resources dedicated to sports provisions. All Divisions will participate in sports competitions coordinated by the NCAA, with SCCs generally employed across colleges to support the development of athletes and optimize sports performance [2].

In the early stages of the profession, those without academic or professional qualifications and experience in strength and conditioning could still be considered SCCs [5]. With the continued development and importance placed on strength and conditioning, SCCs are now expected to possess a range of knowledge and skills, with job roles often asking for relevant certifications to evidence this (i.e., NSCA – Certified Strength and Conditioning Specialist [NSCA–CSCS]) [6]. To identify and describe the profiles of SCCs, Pullo [5] conducted a job characteristic survey of NCAA Division I–A and I–AA SCCs in 1988, which detailed the age, gender, race, highest degree, professional certifications, salary, and other associated information. This research provided important information for practitioners and created a basis for further research to investigate the job characteristics of SCCs at the collegiate-level. Since then, many studies have adapted pullo’s questionnaire to further explore many areas of SCCs, including profession trends [7], leadership behavior [8], practices [9–11], key determining factors for work [12], opinions [13], female SCCs characteristics [14, 15], and characteristics of Division II and III SCCs [16, 17], in addition to demographic and job characteristics. Specifically, although these studies have explored a broad range of topic areas, they have consistently presented key demographic, education, and job information of the SCCs surveyed, providing a foundation for comparison between studies.

Although most results from aforementioned studies were similar, some studies differed (e.g., one study reported that only 24% of coaches’ highest level of education was in a sports performance-related area, while other studies reported 57–83%) [8, 10, 12, 16, 18]. Therefore, this led to inconsistent profiles of NCAA SCCs being presented, affecting our understanding of the demographic and job characteristics of SCCs in the NCAA. It is important to consolidate and clarify this information for early-career coaches entering the profession, those looking to develop in their role (i.e., promotion), and for employers when writing job descriptions. Additionally, it is important to examine the development and changes in this field from a longitudinal perspective, to ensure future planning prioritises best practice and to encourage future

research in this area, which has never been explored before.

The objective of this systematic review was to comprehensively assess the evidence from prior surveys investigating the job characteristics of NCAA SCCs. The findings of this review will help provide a detailed view of the development of strength and conditioning as a profession and identify trends to help us better understand SCC at the collegiate-level. This may inform SCCs at different stages of their career. Moreover, the results of this systematic review will provide a direction for further research by highlighting contemporary areas for discussion or those lacking data or understanding.

METHODS

Experimental Approach to the Problem

This study used the Preferred Reporting Items for Systematic Review and Meta-Analyses Protocol (PRISMA–P) [19] (see Figure 1).

Eligibility Criteria

Studies were eligible if they met the following inclusion criteria: (a) written in English, (b) published in a peer-reviewed journal, as a report on an official website, or a master/doctoral dissertation, (c) reported the demographic and job information of NCAA SCCs, and (d) complete data for at least one common question across two studies were available. The lead author (YMZ) performed a detailed investigation during the planning stage of the systematic review to ensure the selected criteria were relevant.

Information Sources and Search Strategy

Searches for studies were conducted by the lead author (YMZ) from the 12th of October 2022 until the 19th of October 2022, using three electronic databases considered suitable for systematic reviews (Web of Science, EBSCO, and PubMed) [20]. The search string used in Web of Science and EBSCO was: (Topic Search = “Strength and conditioning”) AND (Title = job OR Title = practice OR Title = profile OR Title = survey OR Title = “Strength and conditioning”); In PubMed: (“Strength and conditioning” [Title/Abstract]) AND (Job[Title/Abstract] OR practice[Title/Abstract] OR profile[Title/Abstract] OR survey[Title/Abstract] OR “Strength and conditioning” [Title/Abstract]). The reference

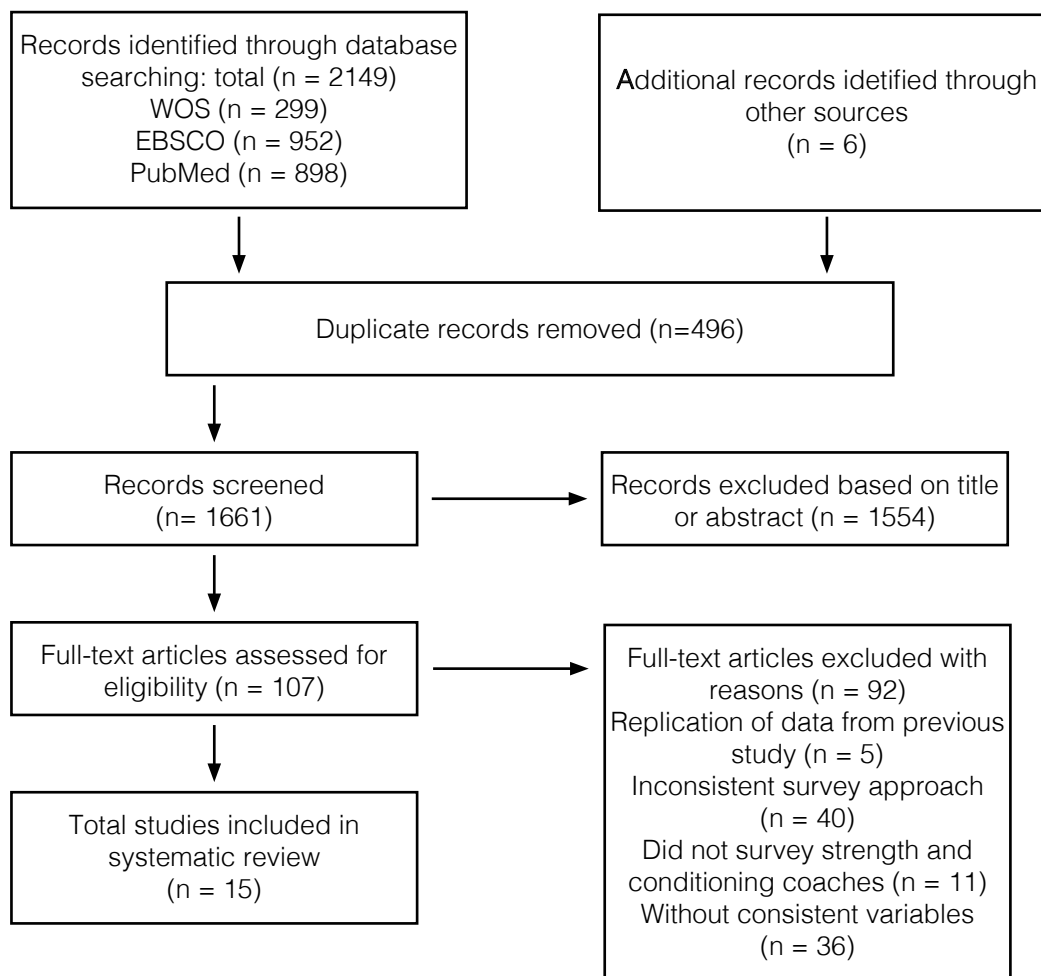


Figure 1. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol (PRIS-MA-P) [24] flowchart illustrating the inclusion and exclusion criteria used in the systematic review.

lists of selected studies were searched for additional suitable studies.

Quality Check

The Critical Appraisal Skills Program (CASP) [21] checklist for qualitative research was used in this systematic review. The CASP checklist consists of three sections, with two initial screening questions and eight further questions exploring the validity and applicability of results to the relevant population. Each question is graded as either: yes, can't tell, or no. Section A evaluates the validity of the results of each study, including the following questions: (1) Was there a clear statement of the aims of the research?; (2) Was a qualitative or mixed quantitative and qualitative methodology appropriate?; (3) Was the research design appropriate to address the aims of the research?; (4) Was the recruitment strategy appropriate to the aims of the research?; (5) Was the data collected in a way that addressed the research issue?; and (6) Has the relationship between researcher and participants been adequately considered? Section B evaluates the quality of results, and includes the following

questions: (7) Have ethical issues been taken into consideration?; (8) Was the data analysis sufficiently rigorous?; and (9) Is there a clear statement of findings? Section C evaluates whether the results will help locally and includes the following question: (10) Is the research valuable? Any disagreements between the reviewers' decisions (YMZ and YML) were discussed and, if unresolved, settled by a third reviewer (AW).

Data Collection Process

The characteristics of all studies included in the review were manually extracted into a customized Excel workbook (Microsoft Excel 2019, Microsoft Corporation, Redmond, Washington, USA). This data included: (1) study information, (2) study appraisal rating, (3) sample size, (4) response rate, (5) published year, (6) age, (7) race, (8) gender, (9) coaching experience, (10) highest academic qualification, (11) major, (12) professional certifications, (13) salary, (14) job title, (15) responsibilities, (16) working hours, and (17) mean values for each included variable. If data were missing or unextractable for an included variable,

all authors reviewed the manuscript and confirmed whether not attainable (-) should be used.

RESULTS

Study Selection

A total of 2,153 studies were obtained through the search strategy (see Figure 1) (Web of Science [$n = 299$], PubMed [$n = 898$], EBSCO [$n = 952$], and other sources [$n = 6$]). After duplicates were removed ($n = 496$) by software (Endnote 20, Thomson Research Soft, Stanford, USA) and a review of the titles and abstracts by two authors (YMZ and YML), 107 relevant articles were identified for further analysis. Two authors (YMZ and YML) then read the full texts, compared the results, and agreed on which studies to include in the systematic review. Finally, 15 studies were selected, quality checked, and agreed upon by all authors for data synthesis. All information derived from the eligible studies is shown in Tables 1 and 2.

Quality Check

The results from the CASP checklist are presented in Table 3. None of the included studies stipulated the relationship between the researcher and participants. Five surveys prior to 2005 did not report ethical issues.

Demographics (age, race, gender, coaching experience)

Demographics, including age, race, gender, and coaching experience, are presented in Tables 1–2.

Education (highest academic qualification, major, professional certification)

Education, including the highest academic qualification, major, and professional certifications held, are presented in Table 1.

Job (salary, job title, responsibility)

Job information, including salaries, job titles, responsibilities, and working hours, is presented in Table 1.

DISCUSSION

This systematic review determined the job

characteristics and identified profession trends of NCAA SCCs over a 34 year period, and our main findings were: (1) most SCC identified as white males, and made up a majority of the coaching demographic, (2) a master's degree with a sports performance-related major and NSCA CSCS were the most frequently reported highest academic and professional qualifications held by SCCs, (3) <2018, it was less frequent for SCCs to have the job title 'SCC', (4) peripheral responsibilities included three categories: i) sports-related work (e.g., video analysis, athlete recruiting), ii) administrative work (e.g., staff meeting, designing the year plan), and iii) teaching work (e.g., academic course, tutoring interns), and finally (5) salaries progressively increased, with a salary gap emerging between SCCs working in higher compared to lower Divisions.

Demographics

From 1989–2022, the average age of SCCs ranged from 31–35 years old, except in one study that specifically investigated head SCCs at the Division I level [18]. Most SCCs employed in NCAA colleges were white (85–100%). According to the data provided by NCAA's official website, 30–40% of student-athletes from 2012–2023 were non-white [24]. Of the non-white athletes it's surprising that more have not found their way into this growing field. Although no studies have explored the reasons for the lack of non-white SCCs in the NCAA, similar situations have occurred in other coaching professions. Therefore, some insights may be generalizable to the SCC profession in the NCAA. Cunningham et al. proposed possible reasons for low percentage of black coaches in the NCAA [25]. First, black coaches may leave the occupation more so than white coaches. Second, black coaches do not contemplate coaching as their primary career pathway. Third, "societal and/or occupational variables (i.e. discriminatory administrative hiring practices, limited career opportunities, etc.)". Cornel Nessler et al. provides several possible explanations for the low number of black coaches in college basketball, such as career plan differences, lack of role models, characteristics of social networks, hiring practices, and organizational structure and culture [26]. These studies suggest that the reasons affecting the representation of black coaches were complex and require further research. A female SCC said in an interview that many colleges and universities are looking for more blacks and minorities to work with their athletes [15]. The authors explained that this was attributed to a significant emphasis at the time to get more diversity

Table 1. Comparison of survey results investigating the job characteristics of strength and conditioning coaches at the collegiate-level.

References		Pullo [5]	Trey [7]	Brooks [9]	Durell [9]	Massey [18]	Martinez [12]	Haggerty [17]	Powers [13]	Massey [16]	Massey [15]	Wade [10]	Laskowski [14]	Waryasz [11]	NSCA [22]	NSCA [23]	Mean
Published year		1992	1998	2000	2003	2004	2004	2005	2008	2009	2013	2014	2016	2016	2018	2022	/
Sample size		145	44	53	137	6	212	57	158	63	6	57	43	208	791	475	164
Response rate		81%	48%	26%	43%	-	68%	10%	-	-	-	29%	29%	-	-	-	42%
Division		1A, AA	1	1A	1	1A	1A,A A, AAA	2.3	1	2	-	1	1	1,2,3	1,2,3	1,2,3	/
Age	Average years	32.6	-	31.3	-	37.8	35.2	34.4	32.7	34.1	31.6	-	-	34.5	-	-	33.8
Race	White	89%	-	85%	-	67%	90%	96%	89%	-	100%	-	-	-	-	-	88%
	Non-white	11%	-	15%	-	33%	10%	4%	11%	-	0%	-	-	-	-	-	12%
Gender	Male	99%	-	85%	-	100%	98%	93%	77%	100%	0%	86%	0%	78%	82%	81%	75%
	Female	1%	-	15%	-	0%	2%	7%	22%	0%	100%	14%	100%	22%	17%	18%	24%
Annual salary in USD	0-9999	5%	-	2%	-	-	-	-	0	3%	-	-	-	-	-	-	/
	10-19999	13%	-	8%	-	-	-	-	0	2%	-	-	-	-	-	-	/
	20-29999	48%	-	32%	-	-	-	-	8%	22%	-	-	-	-	-	-	/
	30-39999	27%	-	25%	-	-	-	-	31%	43%	-	-	-	-	-	-	/
	40-49999	6%	-	21%	-	-	-	-	19%	19%	-	-	-	-	-	-	/
	>50000	1%	-	13%	-	-	-	-	41%	11%	-	-	-	-	-	-	/
	Average	-	41024	-	-	47416	43723	30001-40000	-	-	55583	-	-	-	49286	61923	/
Highest education level	Bachelor's	30%	-	72%	26%	50%	27%	40%	27%	43%	17%	72%	26%	8%	21%	17%	34%
	Master's	66%	-	28%	69%	33%	72%	51%	72%	52%	83%	23%	72%	72%	76%	77%	61%
	Ph.D.	3%	-	0%	5%	0%	0%	5%	1%	5%	0%	0%	0%	0%	3%	6%	2%
Major	Related to sports performance	57%	-	69%	76%	67%	24%	-	80%	-	83%	-	-	80%	78%	81%	69%
	Non-related to sports performance	39%	-	0%	24%	17%	76%	-	20%	-	17%	-	-	0%	22%	18%	23%
	No Answer	5%	-	31%	0%	17%	0%	-	0%	-	0%	-	-	20%	0%	1%	7%

References		Pullo [5]	Trey [7]	Brooks [9]	Durell [9]	Massey [18]	Martinez [12]	Haggerty [17]	Powers [13]	Massey [16]	Massey [15]	Wade [10]	Laskowski [14]	Waryasz [11]	NSCA [22]	NSCA [23]	Mean
Certification	NSCA–CSCS	0%	-	-	75%	0%	76%	72%	78%	32%	83%	70%	86%	74%	99%	99%	65%
	USAW	0%	-	-	23%	0%	4%	19%	49%	8%	50%	58%	63%	56%	50%	-	32%
	CSCCa–SCCC	0%	-	-	0%	50%	19%	9%	51%	10%	67%	0%	0%	35%	5%	-	20%
	None	48%	-	-	0%	33%	0%	0%	0%	62%	0%	0%	0%	0%	-	-	12%
	NSCA–unclear	41%	-	-	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	6%
	NSCA–CPT	0%	-	-	0%	0%	0%	0%	1%	2%	17%	0%	5%	0%	4%	6%	3%
	CSCCa–MCCC	0%	-	-	0%	0%	0%	0%	0%	0%	17%	0%	7%	0%	0%	-	2%
	CSCCa–unclear	0%	-	-	0%	0%	0%	0%	0%	0%	0%	23%	0%	0%	0%	-	2%
Job title	NASM–unclear	0%	-	-	0%	0%	0%	0%	1%	2%	0%	5%	7%	0%	0%	-	1%
	SCC	31%	-	0%	0%	0%	9%	0%	0%	41%	-	-	0%	-	0%	0%	41%
	Assistant SCC	0%	-	49%	0%	0%	0%	0%	73%	0%	-	-	63%	-	46%	40%	30%
	Director of SCC	6%	0%	0%	31%	0%	0%	0%	0%	0%	0%	0%	0%	0%	28%	27%	10%
Responsibilities	Head SCC	0%	-	51%	64%	100%	45%	28%	26%	0%	-	-	0%	-	22%	31%	9%
	Strength and conditioning	69%	-	-	-	100%	-	100%	-	84%	100%	-	100%	-	-	-	92%
	Recruitment	1%	-	-	-	100%	-	81%	-	30%	0%	-	0%	-	-	-	35%
	Administration	0%	-	-	-	0%	-	0%	-	44%	50%	-	5%	-	-	-	17%
	Facility supervision	0%	-	-	-	0%	-	53%	-	2%	33%	-	0%	-	-	-	15%
	Facility maintenance	0%	-	-	-	0%	-	75%	-	2%	0%	-	7%	-	-	-	14%
Working hours	Academic tutor	7%	-	-	-	0%	-	0%	-	17%	17%	-	9%	-	-	-	8%
	Average weekly working hours	-	-	58	-	-	60–100	-	-	64–75	39–60	-	56	52	-	-	-

Note: AF: American Football; USA: United States of America; Ph.D.: Doctor of Philosophy; Related to sports performance: the major learned during the highest education was related to sports performance (e.g., physical education, exercise physiology); NSCA–CSCS: National Strength and Conditioning Association – Certified Strength and Conditioning Specialist; NSCA–CPT: National Strength and Conditioning Association – Certified Personal Trainer; NSCA – unclear: only NSCA was reported without stipulating the certificate possessed; USAW: United States of America Weightlifting; CSCCa–SCCC: Collegiate Strength and Conditioning Coaches' Association – Strength and Conditioning Coach Certified certification; CSCCa–MCCC: Collegiate Strength and Conditioning Coaches' Association – Masters Strength and Conditioning Coaches Certification; CSCCa–unclear, NASM–unclear: only CSCCa/NASM was reported without stipulating the certificate possessed; -: Data was not attainable from the results of the study.

Table 2. Comparison of coaching experience from surveys investigating the job characteristics of strength and conditioning coaches at the collegiate-level.

References		Pullo [5]	Trey [7]	Brooks [9]	Durell [9]	Massey [18]	Martinez [12]	Haggerty [17]	Powers [13]	Massey [16]	Massey [15]	Wade [10]	Laskowski [14]	Waryasz [11]	NSCA [22]	NSCA [23]
Years of coaching experience	SCC	0–5 years	-	-	-	21%	-	-	-	-	-	9%	-	-	42%	36%
		6–10 years	-	-	-	31%	-	-	-	-	-	18%	-	-	29%	27%
		>10 years	-	-	-	48%	-	-	-	-	-	73%	-	-	29%	37%
		Mean	-	9–10	-	-	8.1	-	-	10.1	-	-	-	-	-	-
	All coaching experience (e.g., sports)	0–5 years	-	-	-	-	-	-	-	21%	-	-	-	-	-	-
		6–10 years	-	-	-	-	-	-	-	43%	-	-	-	-	-	-
		>10 years	-	-	-	-	-	-	-	36%	-	-	-	-	-	-
		Mean	-	-	-	-	12.6	-	-	-	8.0	-	-	11.4	-	-
	Collegiate-level	Mean	5.7	-	-	-	-	-	9.9	-	-	-	7.1	-	-	-
	At current institution	0–5 years	-	-	-	63%	-	-	-	75%	-	-	-	-	-	-
		6–10 years	-	-	-	17%	-	-	-	16%	-	-	-	-	-	-
		>10 years	-	-	-	20%	-	-	-	9%	-	-	-	-	-	-
		Mean	-	5–7	4.4	-	6.1	-	-	-	5.0	-	-	-	-	-

Note: SCC: Strength and conditioning coach; -: Data was not attainable from the study results.

Table 3. Critical appraisal using The Critical Appraisal Skills Program (CASP) checklist [21] for qualitative research.

Question	Pullo [5]	Trey [7]	Brooks [9]	Durell [9]	Massey [18]	Martinez [12]	Haggerty [17]	Powers [13]	Massey [16]	Massey [15]	Wade [10]	Laskowski [14]	Waryasz [11]	NSCA [22]	NSCA [23]
Section A: the validity of the results of each study															
Q1 Was there a clear statement of the aims of the research?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Q2 Was a qualitative or mixed quantitative and qualitative methodology appropriate?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Q3 Was the research design appropriate to address the research aims?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Q4 Was the recruitment strategy appropriate to the research aims?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Q5 Was the data collected in a way that addressed the research issue?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Q6 Has the relationship between the researcher and participants been adequately considered?	CT	CT	CT	CT	CT	CT	CT	CT	CT	CT	CT	CT	CT	Y	Y
Section B: the quality of the results of each study															
Q7 Have ethical issues been considered?	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	CT	CT
Q8 Was the data analysis sufficiently rigorous?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Q9 Is there a clear statement of findings?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Section C: whether the results will help locally															
Q10 Is the research valuable?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: Y: Yes, N: No, CT: Can't tell.

on SCCs and have this group better reflect the athletic populations they serve. The demographic data provided by the NCAA's official website also shows that the racial composition of the coaching staff shows a slow upward trend in the percentage of the non-white population [24]. However, the data does not provide data on SCC profession, including only head coach, assistant coach, and strength coach, so there is no evidence to directly confirm the increased representation of non-white practitioner in the SCC population. Given the importance of racial diversity to the profession, future research needs to further explore this issue.

Most SCCs employed in NCAA colleges were male (77–99%). Although two studies specifically investigated female SCCs [14, 15]. It is noted that the data included in this systematic review only represents those SCCs included within prior studies at the time of investigation, therefore, may not generalize to define all SCCs working across the NCAA collegiate-sector. Some research has shown that female coaches may have some advantages in the strength and conditioning profession [14, 15], such as increased job opportunities due to gender equity needs, the ability to connect with female athletes, and department desires to handle specific issues (e.g., body fat test, eating disorders, menstrual cycle, etc.). The dominance of males being employed as SCCs has also shown to be prevalent at different levels (e.g., franchise and elite) [27–30] and regions (e.g., Canada and South Africa) [31–33]. Researchers have investigated the gender disadvantage perceived by female SCCs and reported: less chance of promotion, lack of respect from coaches, players, and administration, inability to work with male teams, being forced to prove oneself, pay inequity, being undervalued, being subject to sexism, and misinterpretation of assertive behavior [14]. Even though problems for female SCCs have been highlighted, data has shown that they occupy about 32–35% of paid positions at the collegiate-level [14]. The increased number of female SCCs employed may be due to colleges intentionally expanding the number of posts fulfilled by female SCCs [34]. Furthermore, although this data seems contrary to that presented in the demographic information in this systematic review, it must be considered that convenience sampling methods were used. Therefore, the only representation of females in prior research is based on those approached or willingness to participate, which may underestimate the number of females employed as SCCs, skewing the data towards a higher proportion of males employed.

The average time SCCs stayed in their current position was 5–7 years, with most (63–75%) SCCs working in their current institution for <5 years and only 9–20% for >10 years. This data may indicate that serving as a SCC at the collegiate-level seems 'unstable'. This may be due to dismissals, promotions (which can potentially increase the risk of dismissal in some scenarios), and changes in sports during career growth. This may also be explained by career goals and aspirations [5, 14, 18]. For example, in the 1989 survey [5], only 21% of Division I SCCs hoped to maintain their job condition, and some hoped to serve as professional-level SCCs (13%) or football coaches (13%). Similarly, in 2005 [17], only a small number of SCCs in Division II (22%) and Division III (27%) hoped to maintain their current role. Others wanted to be athletic coaches (Division II [17%], Division III [35%]) or wanted to advance into Division I (Division II [26%], Division III [9%]) or professional level (Division II [9%], Division III [12%]). Contracts held by SCCs were generally one year or shorter, enabling SCCs to move roles more dynamically, however at the same time limiting job security.

Education

Most (mean 97%) NCAA SCCs possessed a degree, with a master's degree being the most common highest level of qualification (mean 61%). Importantly, from 1989–2022, The proportion of SCCs with a master's degree surveyed rose up to 77%. To obtain the most common professional certification NSCA-CSCS, applicants need a degree related to strength and conditioning. While a master's degree is not a prerequisite for applying for SCC jobs, the academic background of SCCs demonstrates that holding a master's degree may be more favorable to obtain higher-level positions [35]. Although three studies show that the proportion of bachelor's degrees held by SCCs is higher than master's degrees, these studies either were earlier than 2000 or had small sample sizes ($n = 6$). Previous surveys also found that SCCs in Division I and II predominantly possessed a master's degree [17], while the SCCs in Division III mainly possessed a bachelor's degree [5, 17]. This difference may be because higher academic backgrounds provide SCCs with more knowledge and ability to fulfill these higher-level roles [27]. For instance, a survey across 18 countries reported that 25% of SCCs working in professional soccer held a Ph.D. [36]. In addition, SCCs with higher degrees were consistently reported to earn higher salaries [22, 23]. Most (mean 69%) SCCs surveyed majored in a sports performance-related field during their highest degree. With time,

the proportion of SCCs with sports-related majors has also generally increased. This is important as it provides the necessary knowledge and skills to apply in their practice and it introduces this directly to the employer at the time of application. In one study, researchers reported that 24% of SCCs majored in a sport-related field [12]. However, upon investigation, the authors only reported majors of 'sports science' and 'physical education', therefore, underestimating the broader spectrum of education that underpins strength and conditioning (e.g., exercise physiology, exercise psychology).

The most common certification held by SCCs in various surveys was the NSCA-CSCS (mean 65%), which is widely reported as the most common in other strength and conditioning surveys in the USA [9, 11, 12, 14]. Survey results of NSCA SCCs in 2018 and 2022 showed that 99% of NCAA SCCs held the CSCS certification [22, 23]. Given NSCA's geographical location and the nationality it belongs to, the high CSCS holding rate of the NCAA SCCs is reasonable. Meanwhile, with the continuous development of the strength and conditioning industry, the related certifications of different associations are diversifying, which is reflected in the results of this systematic review. In 1988, only NSCA certifications were held in the survey of Division I SCCs [5]. In 2009, 12 different certifications were held in the survey of Division II SCCs [16]. Studies have shown that SCCs in different divisions and positions had different job responsibilities [5, 12, 17]. Therefore, they may need other certifications to provide the relevant knowledge and skills to fulfill their role. For example, The American College of Sports Medicine-Certified Personal Trainer focuses more on the health benefits of fitness, NSCA-CSCS certification focuses more on performance improvement, and USA weightlifting (USAW) courses focuses on coaching weightlifting [13]. Therefore, our results suggest that a master's degree in a sports performance-related major and a NSCA-CSCS certification may become a prerequisite for applying for a SCC job in NCAA in the future.

Job information

After decades of development, the salary of NCAA SCCs has increased (the average salary of SCCs in Division I increased from 41,024 USD in 1998 to 67,935 USD in 2022, and the average salary of SCCs in Division II and III increased from 30,000-40,000 USD in 2005 to 49,941 USD and 56,363 USD in 2022, respectively) [7, 17, 23]. The salary of SCCs in Division I was higher than those in Division

II and III [17], Division I-A was higher than those in 1-AA and AAA [12], and those with superior job roles (e.g., head/director) was higher than other SCCs [14, 15]. This is unsurprising because the colleges participating in higher NCAA divisions have larger revenues and budgets, while SCCs with higher titles take on greater responsibilities (e.g., SCC team development, management, and coordination). Accordingly, employment in higher roles requires commensurate skills and experience (e.g., interpersonal and communication skills, career experience, workplace and academic achievements) [5, 12, 37]. The salary gap between levels and positions is increasing with the development of the strength and conditioning industry. In 1988, the salary gap between 1-A and 1-AA was only 10,000 USD, which grew to 20,000 USD by 2004. While this gap was reduced to \$13,000 in 2018, it was back to \$20,000 by 2022. Although these values represent mean salaries, assessing this on an individual basis may show greater discrepancies (e.g., high salaries for SCCs leading Division I American Football programs).

From 1989–2016, many SCCs did not contain the term 'SCC' in their job title. Results showed only three surveys in 1989–2016 reported that nearly all (99%–100%) SCCs possessed the job title 'SCC' with other surveys reporting this less so (28%–64%). For instance, 31% in Division I [5], 32%–41% in Division II [16, 17], and 26% in Division III [17]. The other commonly reported job titles of SCCs were assistant football coach (73%) [16], and assistant athletic coach (44%) [17], which indicates that the job title of SCCs was usually inconsistent with the responsibilities held. The possible reason for this may be related to the evolving professionalization and definition of the roles and responsibilities of a SCC [3, 5]. This may include some coaches who were not qualified in strength and conditioning or those holding other associated certifications (e.g., USAW) but still provide strength and conditioning services. Interestingly, this was not reported in surveys from 2018 and 2022, with most (96%–98%) SCCs holding roles under the title 'SCC'. This review indicated that the primary responsibility of SCCs surveyed at work is to provide strength and conditioning training services (mean 92%), followed by recruiting athletes (35%) and administrative duties (17%). Surprisingly, although physical testing is essential and routine work carried out by SCCs [30, 36, 38], only one study reported physical testing was included in the responsibilities of coaches. Various peripheral duties were required of SCCs that were unrelated to strength and conditioning training, such as drugs

counseling [17], nutrition counseling [17], video analysis [16], contact scouting [18], supervision of athletes' study [16], office work [16], etc. These can be divided into three categories according to the nature of the work: (1) sports-related work (e.g., video analysis, athlete recruiting), (2) administrative work (e.g., staff meeting, designing the year plan), and (3) teaching work (e.g., academic course, tutoring interns). Although it may be argued that these responsibilities are related to the performance of athletes, it exemplifies the broad-ranging scope of roles associated with strength and conditioning. Studies have shown that although some Division II and III colleges did provide competitive salaries for SCCs, this may lead to increasing their broader responsibilities due to employing a reduced workforce [17]. Contrastingly, SCCs working at Division I usually had one or two assistants [12].

This systematic review includes the following limitations. Firstly, the wording of the question (coaching experience) in each included study was slightly different (e.g., 1. Average years coaching? 2. Average years as a SCC? 3. Years in the coaching profession? 4. How many years have you been working in the exercise field? 5. Average years coaching in college?). This may represent different meanings and influence the overall results and interpretation. Therefore, this study only included data with the same wording for comparison, thus limiting the amount of coaching experience data. Secondly, some questions were open-ended, such as responsibility, which led to a wide variety of answers. To be concise, this study discarded the least frequent responses (e.g., if surveys involved less than 4 responses). Thirdly, the sample size of the included studies was significantly different but did not result in unexplained results. Finally, The data of some studies are outdated, so the limitations of all results as a whole need to be considered when reviewing. But as a snapshot of the time, it reflects the situation at that time. This function is unique.

PRACTICAL APPLICATIONS

This systematic review found that specific characteristics of SCCs have changed from 1989–2022. The available data suggest that white males make up a majority of the demographic in the NCAA. strength and conditioning sector. Therefore, a focus of college administrators may be to diversify the gender and race of their workforce, which will provide job opportunities for female and non-white practitioners. Prospective SCCs looking to work in

NCAA colleges or existing SCCs wanting to develop (e.g., gain promotion) should consider obtaining a master's degree in a sports performance-related area while concurrently obtaining NSCA-CSCS certification as a minimum. Whether other relevant certificates (e.g., USAW) are required depends on the purpose and background of employment. Given the varied job titles held by SCCs, it is important that when searching for roles, people should search for other associated terms (e.g., strength coach, assistant coach). It is suggested that colleges should standardize the job titles as 'SCC', which will help (a) enhance the sense of professional belonging of SCCs and (b) unify professional terms to facilitate future research. Lower-level Divisions (e.g., II and III) and positions (e.g., assistant SCC) may lead to SCCs having more responsibilities and lower salaries due to limited workforce and budgets. This indicates that those looking to become SCCs in the NCAA Divisions II and III should learn multiple skills during their education to meet these various responsibilities (e.g., video analysis and nutrition consultation). Finally, it is suggested that researchers should unify how they collect and report data to make it as complete as possible to facilitate comparisons between studies and to provide a basis for longitudinal investigations (e.g. age/year results reporting both mean \pm standard deviation and range). Therefore, we have developed a survey based on questions used in prior research investigating NCAA SCCs that can be used to standardize data collection in any future investigations (see Appendix 1). This survey may also be adapted to survey different populations.

DECLARATION OF INTEREST STATEMENT

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

FUNDING

This project received no external funding.

INSTITUTIONAL REVIEW BOARD STATEMENT

Not applicable.

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