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Sampling Methods and the Accredited Population in Athletic Training Education Research

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Context: We describe methods of sampling the widely-studied, yet poorly defined, population of accredited athletic training education programs (ATEPs).

Objective: There are two purposes to this study; first to describe the incidence and types of sampling methods used in athletic training education research, and second to clearly define the accredited ATEP population.

Design and Setting: Literature review and web-based information search

Participants: Accredited programs as of January 2008

Measurements: We conducted a literature review with the following limits: (1) articles with keyword "accreditation," (2) articles utilizing accredited ATEP population, (3) articles published in the *Journal of Athletic Training* and the *Athletic Training Education Journal*, and (4) articles published since 2000. We categorized articles based on their sampling method(s). We conducted a web-based search of all accredited programs as of January 2008 and collected demographic data including: state/private affiliation, university enrollment, cost of attendance, National Athletic Trainers' Association district, and athletic affiliation.

Results: Our literature search identified 37 articles. Twenty-seven (73%) articles did not clearly state their sampling methods. Twenty-two (59%) of the articles used some sort of random sampling method. The remaining 15 articles (41%) used some sort of nonrandom sampling method. As of January 2008 there were 360 accredited programs.

Conclusions: The following generalizations can be made: (1) The majority of articles used a random sampling method. (2) The vast majority of programs were undergraduate. (3) A majority of programs are affiliated with state institutions.

Key Words: Sampling methods, accredited programs, demographics

The number of accredited athletic training education programs (ATEPs) has seen explosive growth over the last several years. The Commission on Accreditation of Athletic Training Education (CAATE) office (L. Caruthers, personal e-mail communication, June 2008) reported 202 new programs from 2001 to 2007. Figure 1 displays the growth of accredited programs over time, as reported in research articles noting the population size, from 1998 to 2006.[1-13] To date, no study has clearly defined the population surveyed to give researchers the ability to determine whether or not they have recruited or achieved responses from a representative sample.

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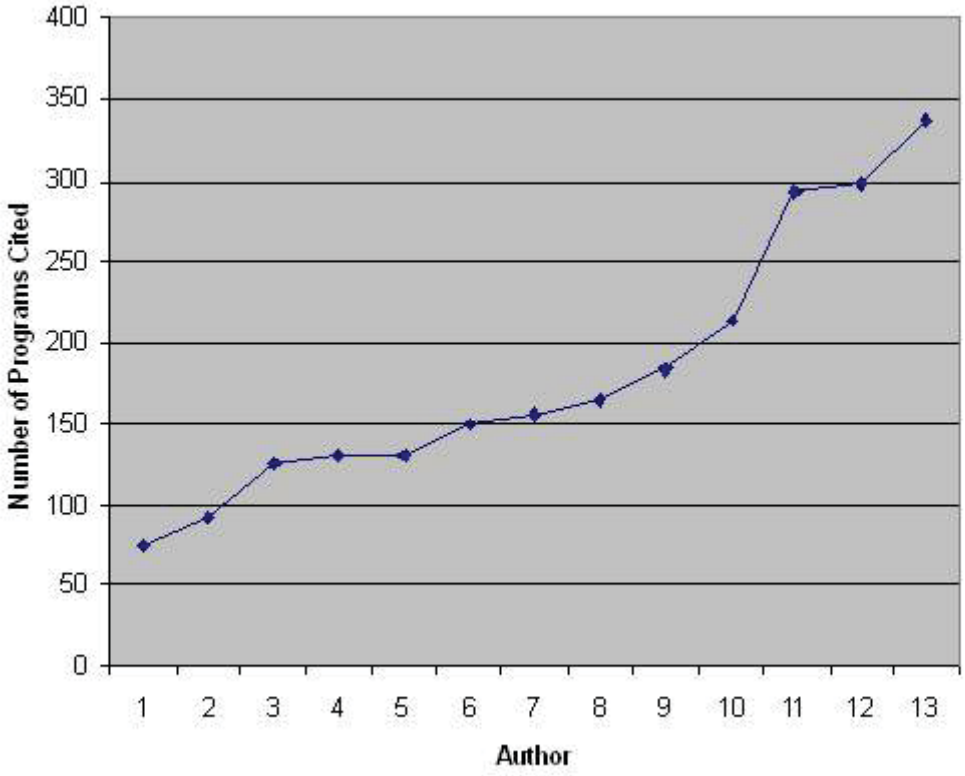
The type of sampling method used in research has a direct impact on the quality of inferences made based on the results of the study. Whether a project is qualitative or quantitative, researchers must determine the number of required subjects and how to select these subjects. As outlined by Onwuegbuzie[14], sampling methods fall into one of two categories, random (probabilistic) and nonrandom (purposive), and researchers have 24 different sampling methods available for use (5 random methods and 19 nonrandom methods). In education research, the sampling method is dictated by the objectives of the study. [15] A simple random method allows every member of the population the same chance of being selected. Variations of random sampling involve dividing the population into subsections (i.e. stratified or cluster) then drawing randomly from those subsections. Researchers can generalize to the entire population inferences based upon the random selection of subjects. Nonrandom sampling methods typically involve the selection of subjects based upon specific characteristics (i.e., critical case) or ease of access to subjects (i.e., convenience). Again, researchers can generalize inferences based upon the nonrandom selection of subjects, but only to the specific characteristics selected. Constructing a representative sample requires knowledge of the entire population studied, and researchers must identify and define discrete characteristics.

The purpose of this article is to describe the incidence of sampling methods commonly used in athletic training (AT)

Figure 1. Growth of Accredited programs as Cited in Research from 1998-2006*



*Authors are listed in the chronological order that their data was collected, not when the article was published.

education research regarding accredited education programs and to define the variable within the population so that future research can strengthen subject sampling methods and the inferences made based on the results of the research.

Methods

We conducted a literature review with the following limits: (1) articles with the keyword "accreditation," (2) articles that used the accredited population, (3) articles published in the *Journal of Athletic Training* and the *Athletic Training Education Journal*, and (4) articles published since 2000. We conducted an analysis of the literature to determine the sampling methods used and specific institution/program demographics reported. When the sampling method was not identified within the article, we independently classified each article into one of the sampling methods as outlined by Onwuegbuzie and Leech.[14] We discussed any disagreements and made modifications to the sampling method classification.

Subjects

We identified the institutions by accessing the Commission on Accreditation of Athletic Training Education (CAATE) web site as of January 2008.[16] The demographic data collected were: entry-level undergraduate/graduate status, state/private funding, college/university enrollment, cost of attendance (instate undergraduate tuition + books + room/board), National Athletic Trainers' Association (NATA) district, length of AT program in years, and the athletic affiliation (NCAA - National Collegiate Athletic Association or NAIA - National Association of Intercollegiate Athletics).

Procedures

We performed a web-based search of each institution and AT program. Each data variable was available via the public domain and did not require Institutional Review Board approval. We obtained institutional information by starting with the main home page, and in most cases, the admissions office web page. We obtained AT program information from the AT home page. When necessary, we researched alternative web-sties (i.e. www.collegeboard.com) for missing or unavailable information.

Statistical Procedures

We used Microsoft Excel™ for the data analysis. We used the basic sorting functions to identify sub-populations (entry-level undergraduate versus graduate) and the descriptive statistics function to describe the population.

Operational Definitions

Institution enrollment was an estimate of total enrollment for undergraduate and graduate students. We calculated the cost of

attendance by adding undergraduate full-time in-state tuition to books/fees and room and board estimates.

Results

Twenty-two of the 37 (59%) articles[2,4-8,10,11,13,17-29] used a random sampling method while the remaining 15 (41%) articles[1,9,30-41] used a nonrandom sampling method. Of the 22 random sampling method articles, six of them (27%)[7,8,21,22,25,27] clearly identified what sampling method(s) was/were used. Of the 15 nonrandom sampling articles, five of them (33%)[3, 35-37, 40] clearly identified within what sampling method(s) was/were used. We confirmed the articles that identified the sampling methods used. For those articles that did not clearly identify the sampling method used, we categorized them according to the procedures previously outlined. As illustrated in Table 1, the most common type of random sampling method (n =11) was stratified while the most common type of nonrandom sampling method (n = 11) was convenience.

Table 1. Incidence of Sampling Methods

Sampling method(s)*	n
Random	
Simple	8
Stratified	11
Stratified-cluster	1
Stratified multistage-cluster	1
Multistage-cluster	1
Non-random	
Convenience	9
Homogenous	2
Stratified-purposeful	2
Random purposeful	1
Theory-based	1

*Sampling methods as described by Onwuegbuzie and Leech[14]

Web-Search

As of January 2008 there were 360 accredited programs. There were 343 (95.2%) entry-level undergraduate and 17 (4.7%) entry-level masters programs. There were 195 (54.1%) state-affiliated and 164 (45.5%) private-affiliated institutions. The average institution enrollment was 9436 (± 9813, min = 303, max = 50377) students. The average cost of attendance was $20,466 (±$8,126, min = $3,033, max = $50,760). The distribution of institutions by district is skewed with District 4 having 89 (25%) and District 10 having only 12 (3%) institutions (Table 2). The average length of the ATEP was 2.98 (± .73) years. Athletic competition affiliation was primarily NCAA Division I with 145, Division II with 90, Division III with 99, and NAIA with 26 (Table 3).

Table 2. NATA District Distribution of Accredited Programs

District	n	%
1[a]	24	7
2[b]	36	10
3[c]	52	14
4[d]	89	25
5[e]	46	13
6[f]	25	7
7[g]	14	4
8[h]	18	5
9[i]	44	12
10[j]	12	3
Total	**360**	**100**

[a]Connecticut, Rhode Island, Massachusetts, Vermont, New Hamphire, Maine
[b]Delaware, Pennsylvania, New Jersey, New York
[c]S. Carolina, N. Carolina, Virginia, W. Virginia, Maryland, District of Columbia
[d]Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin
[e]Oklahoma, Kansas, Missouri, Iowa, Nebraska, N. Dakota, S. Dakota
[f]Texas, Arkansas
[g]Arizona, Coloradi, New Mexico, Utah, Wyoming
[h]California, Hawaii, Nevada
[i]Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, Tennessee, Puerto Rico, Virgin Islands
[j]Washington, Oregon, Idaho, Montana, Alaska

Table 3. Athletic Affiliation and Private/State Funding for Whole Population, Undergraduate, and Graduate Programs

Affiliation	Overall	%	Under-grad	%	Grad	%
[a]NCAA Division I	145	40	137	39	8	47
[a]NCAA Division II	90	25	85	25	5	29
[a]NCAA Division III	99	28	95	28	4	24
[b]NAIA	26	7	26	8	0	0
Private funded institution	164	45.5	160	47	13	76
State funded institution	196	54.4	183	53	4	24

[a]National Collegiate Athletic Association
[b]National Association of Intercollegiate Athletics

Discussion

Of the 22 articles that used a random sample, six[2, 7, 13, 22, 25, 29] reported demographic variables similar to those that we captured in

our web-based search of the entire population. While their results may have been representative at the time, we can now present the most recent data with regard to the same demographic variables. The following is a discussion of those articles' sampling methods and results as related to the demographics that we captured. While there are no statistical methods for determining the degree to which a sample is representative, we made a conservative ± 3% assumption for determining if the reported sample is representative.

Caswell and Gould[7] used a stratified, multistage, cluster-random sample of 155 programs (accredited as of July, 2002) with a response rate of 83%. The sample frame was limited to accredited programs at that time and clustered with NCAA athletic affiliation (Division I as one cluster and Division II and III as another cluster). Three levels of stratification were incorporated to yield a random sample of students and educators. Their results for NATA District distribution were only partial and are presented in Table 4. Their results for NCAA athletic affiliation are presented in Table 4. We present our results for athletic affiliation and NATA District distribution in Tables 2 and 3. Based upon our ±3% assumption, and assuming no dramatic changes in the distributions over roughly six years, they did not achieve a representative sample based upon NCAA athletic affiliation and NATA District.

Weidner et al.[25] used a stratified random sample of 124 programs (accredited as of October, 2003) with a response rate of 50%. The sample frame was limited to all accredited programs at that time with NCAA athletic affiliation. Their results for NCAA athletic affiliation distribution are presented in Table 4. We present our results for athletic affiliation distribution in Table 3. Based on our ±3% assumption, and assuming no dramatic changes in distributions over roughly five years, they achieved a representative sample based upon the NCAA Division II athletic affiliation.

Table 4. Selected Random Sample Articles: Reported Institution Demographics

Author	Caswell & Gould[7]*	Weidner et al[25]	Weidner & Pipkin[22]	Walker et al[13]	Weidner & Laurent[2]	Udermann et al[29]#
Demographic	**%**	**%**	**%**	**%**	**%**	**%**
Athletic affiliation						
NCAA D I	44	34.4	30.4	42.8		36.4
NCAA D II	56	24.6	37.0	18.9		23.6
NCAA D III	56	41.0	32.6	26.4		28.6
NAIA				11.9		11.4
NATA District						
1					14	
2	25				26	
3					7	
4	32				28	
5					0	
6					3	
7					3	
8					0	
9					18	
10					0	
Private affiliation						47.9
State affiliation						51.2

*Clustered sample combined NCAA Div II and III

#Reported results limited to entry-level undergraduate programs only

Weidner and Pipkin[22] used a stratified random sample of 261 programs with a response rate of 35.6%. It is not clear from the article when they captured the data. The sample frame was limited to all accredited programs at that time and stratified by NCAA athletic affiliation. Their results for NCAA athletic affiliation distribution are presented in Table 4. We present our results for athletic affiliation distribution in Table 3. The percentage distribution they reported is greater than ± 3% from the percentage we found. Based upon our ±3% assumption, and assuming no dramatic changes in distributions over time, they did not achieve a representative sample based upon the NCAA athletic affiliation.

Walker et al.[13] used a simple random sample of 337 programs (accredited as of January 2006) with a response rate of 59.6%. The sample frame included all accredited programs. Their results for athletic affiliation distribution are presented in Table 4. We present our results for athletic affiliation distribution in Table 3. Based upon our ±3% assumption, and assuming no dramatic changes in distributions over roughly two years, they did achieve a representative sample based upon the NCAA Division I and III athletic affiliation.

Weidner and Laurent[2] used a simple random sample of 93 programs (accredited as of the fall of1998) with a response rate of 30%. The sample frame included all accredited programs at that time. Their results for NATA District distribution were limited to seven of the 10 districts and are presented in Table 4. We present our results for NATA District distribution in Table 2. Based upon our ±3% assumption, and assuming no dramatic changes in distributions over roughly ten years, they did achieve a representative sample based upon NATA District 2.

Udermann et al.[29] used a stratified random sample of 291 programs (accredited as of the fall of 2004) with a response rate of 49%. The sample frame was limited to only entry-level undergraduate programs. Their results for athletic affiliation distribution and private/state institution affiliation are presented in Table 4. We present our results for athletic affiliation distribution and private/state institution affiliation in Table 3. Based upon our ±3% assumption, and assuming no dramatic changes in distributions over roughly four years, they did achieve a representative sample based upon NCAA Division II and III athletic affiliation and private/state institutional affiliation.

We have limited the institutional and program-level demographics reported in our literature review to athletic affiliation, NATA District, and private/public institution affiliation. We captured additional institutional and programmatic variables (institution enrollment, cost, and length of ATEP) that should allow future researchers to target representative samples and thus increase the voracity of the inferences they make about the population as a whole (Tables 5 and 6).

Table 5. Program Distribution by State*

State	n	Undergraduate	Graduate
Alabama	6	6	
Alaska	0		
Arizona	2	2	
Arkansas	7	6	1
California	16	16	
Colorado	5	5	
Connecticut	5	5	
Delaware	1	1	
District of Columbia	1	1	
Florida	13	13	
Georgia	5	5	
Hawaii	1		1
Idaho	2	2	
Illinois	14	14	
Indiana	11	11	
Iowa	13	13	
Kansas	12	12	
Kentucky	3	3	
Louisiana	5	5	
Maine	4	4	
Maryland	3	3	
Massachusetts	10	9	1
Michigan	13	13	
Minnesota	7	7	
Mississippi	2	2	
Missouri	11	11	
Montana	2	1	1
Nebraska	6	5	1
Nevada	1	1	
New Hampshire	5	4	1
New Jersey	5	4	1
New Mexico	2	2	
New York	11	9	2
North Carolina	21	20	1
North Dakota	4	3	1
Ohio	26	25	1
Oklahoma	5	5	
Oregon	3	3	
Pennsylvania	19	19	
Rhode Island	0		
South Carolina	7	7	
South Dakota	5	4	1
Tennessee	10	9	1
Texas	18	16	2
Utah	3	3	
Vermont	3	3	
Virginia	11	10	1
Washington	3	3	
West Virginia	6	6	
Wisconsin	10	10	
Wyoming	1	1	
Total	360	343	17

*Based upon accredited programs as of January 2008

Conclusions

The majority of research in AT education published from 2000 to 2008 used a random sampling method (59%). Numerous articles[1,9,30-41] have discussed intriguing subjects but were based upon nonrandom subject selection, thus the results cannot be inferred to the entire population. Athletic training education research is often qualitative or mixed methods in nature, covering concepts that are applicable to all programs. Whenever possible, subject selection needs to utilize a random method so that all

Table 6. Mean and Standard Deviation for Enrollment, Cost, and Length of ATEP

	Mean	SD
Whole population		
Enrollment	9436.89	9800.62
Cost	20466.18	8126.19
Length	2.98	.73
State institutions		
Enrollment	14068.11	10372.49
Cost	15575.56	4841.69
Length	2.84	.71
Private institutions		
Enrollment	4020.61	7651.53
Cost	25923.80	5307.66
Length	3.16	.71
Undergraduate		
Enrollment	9423.00	9769.00
Cost	20437.02	8068.38
Length	3.03	.71
Graduate		
Enrollment	9859.00	10732.00
Cost	19464.35	9439.34
Length	2.18	.35

programs can benefit from the results. As research projects are planned, it is important to have an accurate description of the population being studied.

The population of accredited programs is ever-changing and will evolve over time. We have presented an accurate description of the population at this time based upon several commonly used, and a few additional, demographics. Researchers need to use this information when selecting subjects with the goal of obtaining a representative sample.

Future Research

The results of the web-based search are time-sensitive as the list of accredited programs will change over time. Researchers could conduct a similar periodic review (every 2-3 years) to provide an accurate description of the population. Additional demographics about the institution (i.e., Carnegie classification) and program (size estimates; students, ACIs, clinical sites, etc.) should be included in follow-up reviews of the population.

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