

Practice Patterns of Athletic Trainers Regarding the On-Site Management of Patients With Joint Dislocations

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Context: As part of clinical practice, athletic trainers (ATs) provide immediate management of patients with acute joint dislocations. Management techniques may include on-site closed joint reduction of the dislocated joint. Although joint reduction is part of the 2020 educational standards, currently practicing ATs may have various levels of exposure, knowledge, and skills.

Objective: To capture AT self-reported knowledge and practice patterns concerning closed joint reductions.

Design: Cohort study.

Setting: Online survey (Qualtrics).

Patients or Other Participants: The survey link was emailed to 5000 certified ATs. A total of 772 responses were completed by certified ATs with clinical practice experience (15.4% response rate).

Main Outcome Measure(s): Participants were asked to complete a survey about their practice patterns concerning patients with closed joint reductions, which included questions about the types of closed reductions ATs performed most commonly, the frequency of on-site reduction by ATs, and participants' demographic information. Additionally, the survey addressed the ATs' training and comfort level in performing

closed reductions and knowledge of standing orders and the state practice act.

Results: Ninety percent ($n = 694$) of ATs reported ever performing a closed reduction (either with or without a physician present), with 10% ($n = 78$) stating they had never performed a joint reduction. The interphalangeal joint of the finger (73.2% of ATs), shoulder (63.3%), and patella (48.2%) were cited as the 3 most common reductions performed without a physician present. Only 46.5% ($n = 359$) of ATs indicated receiving training in joint-reduction techniques as part of their precertification athletic training curriculum or program; a greater percentage (64%) said they learned directly from a physician. Fewer than 60% of ATs reported having standing orders related to joint reductions.

Conclusions: Considering the high percentage of ATs who reported performing closed joint reductions and the low percentage with formal training, further development of joint-reduction training and standing orders is warranted.

Key Words: closed joint reduction, emergency management, on-site reduction

Key Points

- Most athletic trainers (ATs; 90%) reduced on-site joint dislocations in their clinical practice, although the frequency with which they performed reductions was typically low (annually or less than once per year).
- Dislocations of the interphalangeal joint, glenohumeral joint, and patellofemoral joint were the 3 most common reductions performed by ATs.
- Education of ATs regarding appropriate joint-reduction procedures was inconsistent and included entry-level instruction, hands-on clinical training from physicians or other ATs, and individual reading.

Joint dislocations constitute a small but important percentage of all athletic injuries.¹ Management of a joint dislocation typically involves initial evaluation, followed by either on-site closed reduction or referral to an emergency care center for reduction. On-site closed reductions have several benefits, including higher relocation success rates² and improved patient comfort, joint integrity, and functional prognosis.³

In the United States, athletic trainers (ATs) are the health care providers most likely to be present on-site during athletic practices and competitions. Thus, the initial management of patients with joint dislocations often falls to ATs. However, historically, whether performing closed joint reductions was within an AT's scope of practice has

been a controversial topic. For example, 2 prominent athletic training texts^{4,5} stated that closed reductions were outside the scope of practice of an AT and thus should be attempted only by a physician. Anecdotally, many ATs admit to performing closed reductions but do not want to go "on the record," possibly due to concerns about legal liability based on their scope of practice.

The 2019 National Athletic Trainers' Association (NATA) position statement on the immediate management of appendicular joint dislocations⁶ clarified that joint reductions are within an AT's scope of practice. Additionally, starting in 2020, the athletic training education standards included joint reductions in the curriculum.⁷ This change marks an important shift in clinical practice for

many ATs, but the literature has not caught up. To date, only 3 known articles⁷⁻⁹ addressed the performance of closed joint reductions by ATs. Instead, the broader literature is most commonly targeted at physicians. Many articles and chapters addressed appropriate joint-reduction techniques for specific joints^{3,10-16} as well as physician practice patterns regarding joint reductions.^{17,18} Although these sources provide valuable information, many unanswered questions persist. Of particular interest are the current practice patterns of ATs, including the joints most commonly reduced by ATs, the frequency of on-site reductions by ATs, and ATs' training and comfort level in performing closed reductions. Understanding ATs' current practice patterns may help shape future training, educational resources, and research. Therefore, the purpose of our study was to capture ATs' self-reported knowledge and practice patterns concerning closed joint reductions.

METHODS

Participants were recruited through the NATA data-collection service program. This service provides access to NATA members for a single study through the NATA Qualtrics platform (Qualtrics LLC). The original recruitment email was sent to 5000 certified ATs who were members of the NATA on March 20, 2020. A reminder email was sent every week for the next 4 weeks. Data collection was closed on April 21, 2020. Two \$50 gift cards were given to randomly selected participants as an incentive. Institutional review board approval was obtained before survey distribution. The recruitment email gave consent information, and participants indicated informed consent by clicking on the survey link.

Respondents were asked to complete a survey about their practice patterns concerning patients with closed joint reductions. First, the inclusion criteria were verified, and recruits who failed to meet the criteria were excluded from the study using survey logic functions. Inclusion criteria were (1) being a certified AT and (2) either currently or formerly engaging in direct patient care as an AT on at least a half-time basis (20 hours per week). The survey included questions about the types of closed reductions ATs most commonly performed, the frequency of on-site reductions by ATs, and participant demographic information. Additionally, the survey addressed the AT's training and comfort level in performing closed reductions, as well as his or her knowledge of standing orders and the state practice act (Appendix). Because a preexisting validated survey instrument was not available for this topic, we designed the current survey based on our own expertise in the content area. The survey was then pilot tested by 7 certified ATs at our respective institutions. Individuals in the pilot study were asked to provide feedback about any items that were confusing, items that did not offer appropriate response options, or any other general topics. The survey was then revised based on (1) pilot participant feedback and (2) investigator review of pilot responses. We estimated the survey would take approximately 10 minutes to complete.

Data Analysis

Data were exported from Qualtrics to Excel (version 2016; Microsoft Corp) and then imported into SPSS

(version 23; IBM Corp) for analysis. All survey items were analyzed descriptively as frequencies and percentages or mean \pm SD.

Also, we used a preplanned exploratory analysis with χ^2 tests to assess the relationship between the frequency of joint reduction and selected demographic and situational variables ($\alpha = .05$). We selected variables that we hypothesized might help explain the reported clinical practice patterns. For variables with multiple low-frequency categories, we collapsed categories to facilitate analysis (eg, for *clinical setting*, 3 relatively rare categories were collapsed in a single *other* category). Data for frequency of joint reduction were collapsed into 3 categories: *high frequency* (daily to every couple of months), *low frequency* (yearly, less than once per year, or other), and *never*. The demographic variable for route to certification was split into 2 variables based on the number of years certified (0-15 years and >15 years) because 1 option (the internship route) was discontinued approximately 15 years ago and, thus, all individuals in this category would also have more years of experience (which could have confounded the results). If the χ^2 omnibus test value was significant, post hoc tests to identify which value(s) was (were) significant were performed. For post hoc testing, α was set at .10 initially and then Bonferroni adjusted by the number of comparisons per χ^2 test (range = 6-18 comparisons).

RESULTS

A total of 816 surveys were started and 778 were completed. Six completed responses were excluded from data analysis for failing to meet the inclusion criteria (3 respondents were not certified ATs, and 3 did not have sufficient direct patient care experience). The final sample was composed of 772 participants (final response rate = 15.4%). Median time to complete the survey was 5.6 minutes (average = 16.8 minutes). Participant demographic data are reported in Table 1.

Frequency of Closed Joint Reductions by ATs

A total of 90% (n = 694) of ATs acknowledged ever performing a closed reduction (either with or without a physician present), with 10% (n = 78) commenting that they had never performed a joint reduction (Figure 1). Among the ATs who described ever performing a joint reduction, the average number of career reductions performed was 9.6 ± 8.9 (range = 1-31). The self-reported frequency of reductions by ATs without a physician present is shown in Figure 2.

Joint Reductions Performed With a Physician Present

Sixty-four percent of participants (n = 494) indicated that they had performed or assisted with at least 1 closed joint reduction in the presence of a physician. Thirty-six percent (n = 278) stated they had never performed or assisted with a closed joint reduction with a physician present. The types of reductions performed with a physician present are shown in Figure 3. Dislocations of the shoulder (53.9% of ATs), interphalangeal joint of the finger (49.7%), and patella (36.7%) were the 3 most commonly reported reductions (Figure 3). Values for the interphalangeal joint and metacarpophalangeal joint of the finger were provided

Table 1. Athletic Trainers' Demographics (N = 772)

Characteristic	n (%)
Practice status	
Currently practicing >20 h/wk	716 (92.3)
Formerly practiced >20 h/wk	56 (7.3)
Clinical setting	
University or college	361 (48.8)
Secondary school	365 (47.3)
Therapy or rehabilitation clinic	5 (0.6)
Physician practice	4 (0.5)
Professional sports	29 (3.8)
Other	8 (1.0)
Route to certification by the Board of Certification	
Internship	159 (20.6)
Accredited undergraduate program	514 (66.6)
Accredited master's program	96 (12.4)
Other	3 (0.4)
No. of years certified	
0–5	303 (39.2)
6–10	130 (16.8)
11–15	51 (6.6)
16–20	88 (11.4)
21–25	76 (9.8)
>25	124 (16.1)
Age, y	
<30	351 (45.5)
31–40	152 (19.7)
41–50	128 (16.6)
51–60	103 (13.3)
61–70	30 (3.9)
>70	4 (0.5)
Prefer not to disclose	4 (0.5)
Gender	
Male	372 (48.2)
Female	385 (49.9)
Other gender identity	2 (0.3)
Prefer not to disclose	13 (1.7)
National Athletic Trainers' Association District	
1	55 (7.1)
2	107 (13.9)
3	79 (10.2)
4	144 (18.7)
5	74 (9.6)
6	74 (9.6)
7	50 (6.5)
8	59 (7.7)
9	82 (10.6)
10	47 (6.1)

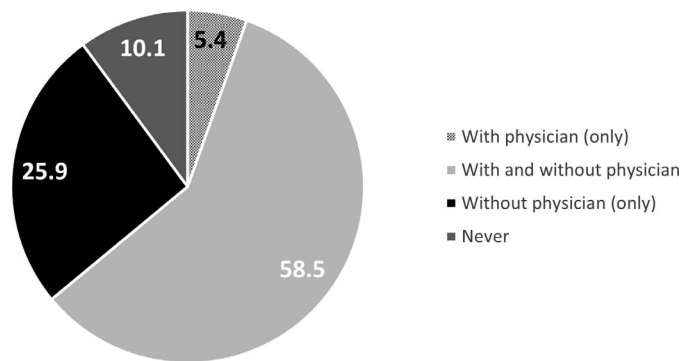


Figure 1. Percentage of athletic trainers who reported ever performing a joint reduction, either with or without a physician present (N = 772).

metacarpophalangeal joint of the finger were supplied separately, and the combined percentage of ATs who conveyed performing either or both was 76.6%.

Patient Populations With Joint Dislocations Reduced

Most ATs reported performing a closed reduction on adults (ages 18–54; n = 458, 59.3%) or adolescents (ages 13–17; n = 394, 51.0%). A minority of ATs acknowledged performing a closed reduction on a child (age <13; n = 19, 2.5%) or a senior (age 55 or older; n = 6, 0.8%).

Estimates of Care Delays Related to Referral of Patients With Dislocations

Participants were given the following scenario: “In your most recent clinical setting, imagine you chose NOT to reduce a dislocated joint and instead refer your patient to the closest hospital emergency department for care.” They were then asked to estimate how long care would be delayed between leaving the AT’s facility and arriving at the emergency department. Most ATs selected a 0- to 15-minute or 16- to 30-minute delay (Table 2).

Then, participants were asked to estimate how long care would be delayed for a patient waiting in the emergency department (eg, the time between arriving at the emergency department and actually receiving care). Most selected a 46- to 60-minute or 16- to 30-minute delay due to wait time (Table 2).

Training and Comfort in Performing Closed Joint Reductions

Only 46.5% (n = 359) of ATs described training in joint-reduction techniques as part of their precertification athletic training curriculum or program; 42.5% (n = 328) denied receiving such training and 11% (n = 85) were unsure.

The methods ATs reported having used to learn appropriate reduction procedures or techniques are listed in Table 3. The 3 most common methods (from most to least frequent) were hands-on clinical training from a physician (64%), reading about joint reduction (47.3%), and hands-on clinical training from a preceptor (41.3%). The ATs’ comfort in performing closed joint reductions varied substantially among individuals (as evidenced by the wide ranges of scores) and were based on the specific joint

separately, and the combined percentage of ATs who discussed performing either or both was 52.5%.

Joint Reductions Performed Without a Physician Present

A total of 84% of participants (n = 652) indicated that they had performed or assisted with at least 1 closed joint reduction without a physician present. Only 15% (n = 120) commented that they had never performed or assisted with a closed joint reduction without a physician present. The types of reductions performed without a physician present appear in Figure 4. Dislocations of the interphalangeal joint of the finger (73.2% of ATs), shoulder (63.3%), and patella (48.2%) were the 3 most commonly reported reductions (Figure 4). Numbers for the interphalangeal joint and

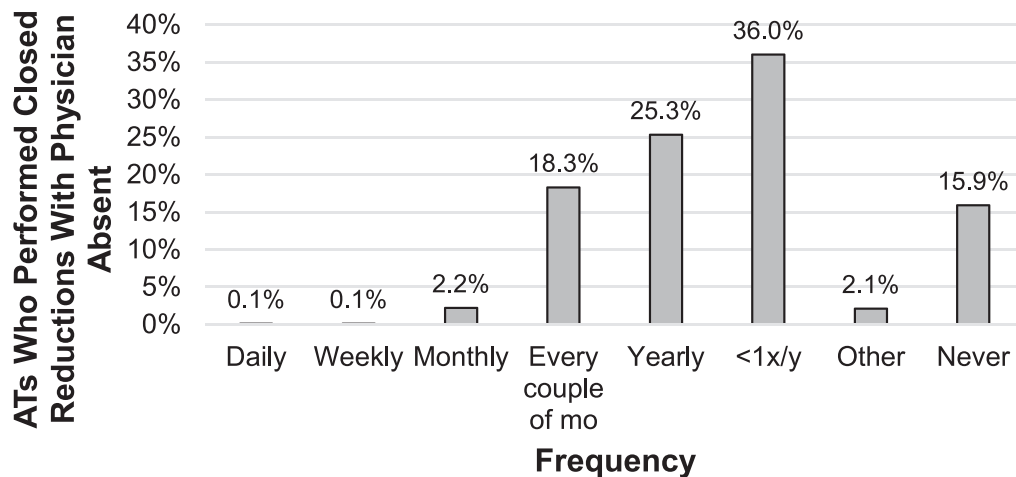


Figure 2. Frequency of athletic trainers (ATs) who reported performing closed joint reductions without a physician present (N = 772).

in need of reduction (Table 4). The reduction techniques ATs were most comfortable with were the finger interphalangeal joint, patellofemoral joint, and metacarpophalangeal joint (Table 4).

Knowledge of Standing Orders and State Practice Acts Related to Performing Joint Reductions

Roughly one-third (34.8%) of participants said they had written standing orders regarding joint reductions, another one-third (35.4%) stated no written orders were available, and the remaining ATs (29.8%) were uncertain (Table 5). A larger portion, 57.5%, indicated having oral standing orders related to joint reductions. Of those individuals who specified having written or oral standing orders, most (89.2% and 89.8%, respectively) observed that their orders permitted reduction of joint dislocations. Of the 652 ATs who explained they performed reductions without a physician present, 484 (74.2%) reported having either written or oral standing orders, and 168 (25.8%) either did not have standing orders or were uncertain.

Thirty-two percent (n = 247) of ATs remarked that reduction of joint dislocations was not directly addressed in their state practice act, and most (n = 466, 60.4%) admitted they were not clear on whether joint reductions were directly addressed in their state's practice act (Table 5). Of the small number of participants (n = 59, 7.6%) who conveyed that their state practice act directly addressed joint reductions, just over one-half (n = 35, 59.3%) noted that joint reductions were permitted (Table 5).

Characteristics Associated with Unsupervised Joint Reduction by an AT

We performed an exploratory analysis using χ^2 tests to assess any association between the self-reported frequency of performing a joint reduction without a physician present and selected demographic (Table 6) and situational (Table 7) factors. The frequency of joint reduction was significantly associated with every selected demographic factor, including clinical setting, route to certification by the Board of Certification (BOC), number of years certified, and

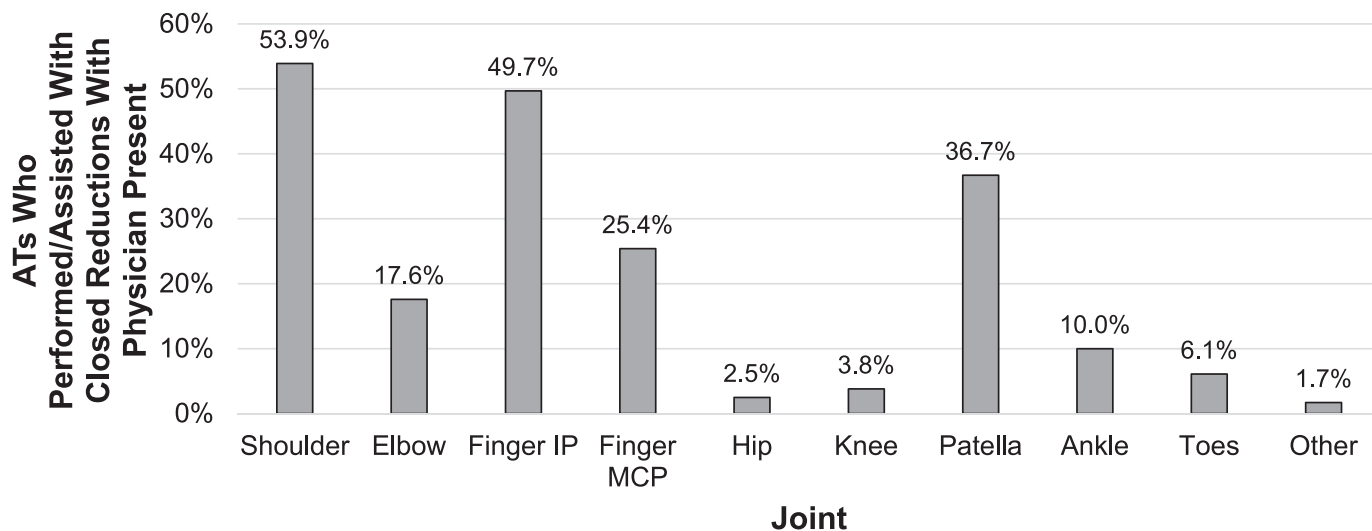


Figure 3. Percentage of athletic trainers (ATs) who reported performing or assisting with each type of joint reduction when a physician was present. Abbreviations: IP, interphalangeal joint; MCP, metacarpophalangeal joint.

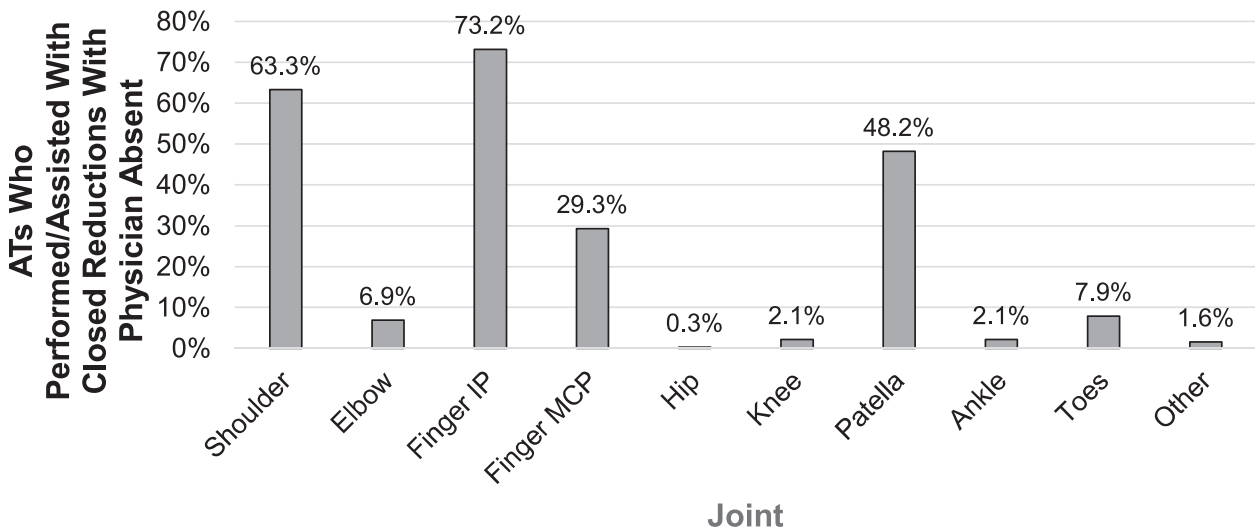


Figure 4. Percentage of athletic trainers who reported performing or assisting with each type of joint reduction without a physician present. Abbreviations: IP, interphalangeal joint; MCP, metacarpophalangeal joint.

gender (Table 6). Using a post hoc analysis, we found that participants in the high school setting were more likely to be in the high-frequency joint-reduction category ($P = .006$). The ATs who were certified for 0 to 5 years were much more likely to report never performing a joint reduction ($P < .001$). Participants with 0 to 15 years of experience who were certified via an accredited undergraduate program were less likely to report a high frequency of joint reductions ($P = .004$), whereas those certified via an accredited master's program were more likely to report a high frequency ($P = .004$). Among individuals with more than 15 years of experience, the frequency of reductions was not different among those certified via the 3 possible routes to BOC eligibility (internship, accredited undergraduate program, or accredited master's program; $P = .346$). Lastly, females were more likely to describe never having performed a reduction ($P = .007$).

Table 2. Athletic Trainers' Estimates of Delays in Care Related to Referral of a Patient With a Dislocated Joint

Scenario	n (%)
Estimated delay in care from athletic training facility to arrival at emergency department, min	
0–15	356 (46.1)
16–30	296 (38.3)
31–45	75 (9.7)
46–60	30 (3.9)
>60	15 (1.9)
Estimated wait from arrival at emergency room to receiving care, min	
0–15	77 (10.0)
16–30	180 (23.3)
31–45	162 (21.0)
46–60	181 (23.4)
61–75	87 (11.3)
76–90	38 (4.9)
>90	44 (5.7)
Other or did not respond	3 (0.4)

The frequency of joint reduction was significantly associated with selected situational factors, including the estimated delay in care for transport to the emergency department, estimated wait time in the emergency department, entry-level training in joint reduction, having written standing orders, and having oral standing orders (Table 7). The frequency of joint reduction was not significantly associated with whether the state practice act directly addressed reductions. Using post hoc analysis, we determined that participants with low estimated care delays for transport to the emergency department or estimated wait times in the emergency department were less likely to perform on-site reductions (both P values $< .001$). The ATs whose entry-level education included joint-reduction training were less likely to have never reduced a dislocation ($P < .001$), whereas those without such training were more likely to report never having performed a reduction ($P = .003$). Participants with standing orders (written or oral) were more likely to have performed joint reductions at a high frequency ($P = .004$ and $P < .001$, respectively) and less likely to have never performed a reduction (both P values $< .001$). Those without standing orders (written or oral) were also less likely to have reduced a dislocation (both P values $< .001$).

Table 3. Most Common Training Methods Used by Athletic Trainers to Learn Appropriate Joint-Reduction Procedures or Techniques

Type of Training	n (%)
Received hands-on clinical training from physician	494 (64.0)
Read about joint reduction (eg, articles, textbook)	365 (47.3)
Received hands-on clinical training from preceptor	319 (41.3)
Received hands-on clinical training from colleague	289 (37.4)
Part of a course during entry-level professional education	273 (35.4)
Completed workshop or continuing education course	173 (22.4)
Part of a course during postprofessional or advanced education	149 (19.3)
Other	16 (2.1)
None of the above	22 (2.8)

Table 4. Athletic Trainers' Comfort Performing an On-Site Joint Reduction Without a Physician Present^a

Joint	Mean ± SD	Minimum, Maximum
Finger: interphalangeal	1.40 ± 0.78	1, 5
Patella: patellofemoral	1.85 ± 1.03	1, 5
Finger: metacarpophalangeal	2.08 ± 1.11	1, 5
Shoulder: glenohumeral	2.15 ± 1.25	1, 5
Toe: interphalangeal	2.31 ± 1.12	1, 5
Elbow: radioulnar or humeroulnar	4.23 ± 1.08	1, 5
Ankle: talocrural or subtalar	4.26 ± 1.02	1, 5
Knee: tibiofemoral	4.58 ± 0.80	1, 5
Hip: coxofemoral	4.74 ± 0.62	1, 5

^a Items were rated on a Likert-type scale, with 1 = *very comfortable*, 2 = *somewhat comfortable*, 3 = *neither comfortable nor uncomfortable*, 4 = *somewhat uncomfortable*, 5 = *very uncomfortable*.

DISCUSSION

The purpose of our study was to capture data on ATs' self-reported joint-reduction practice patterns, training, and knowledge. Topics of particular interest were the frequency of on-site reductions by ATs, the types of closed reductions ATs most commonly performed, and ATs' training and comfort level in performing closed reductions. Our hope is that understanding current practice patterns may help shape future training, resources, and research that will in turn affect future clinical practice. A secondary aim was to identify factors significantly associated with a high frequency of either performing joint reductions or never performing joint reductions.

Frequency of On-Site Reduction by ATs

Most ATs (89.9%) reported that they performed joint reductions as part of their practice, averaging 9.6 reductions over the course of their career and most often performing less than 1 reduction per year. These data are interesting for several reasons. First, until the NATA position statement on the immediate management of appendicular joint dislocations⁶ was released in January of 2019, it was unclear if joint reductions were within the AT's scope of practice. Until then, written guidance typically indicated that only physicians should perform closed reductions,⁴ with few

exceptions.⁸ We collected the current survey data approximately 14 months after the release of the NATA position statement, and yet, most ATs already indicated performing joint reductions, although infrequently. This finding seems to suggest that ATs have been performing joint reductions for quite some time, despite the procedures only recently being officially recognized as within their scope of practice.^{6,7} Educators may recall the considerable debate during the open comment period for the 2020 curriculum standards about whether closed joint reductions should be included in the educational standard at all. The results of this study do not answer the philosophical question of whether or not ATs should be permitted to perform joint reductions, but they do offer evidence that ATs are performing this skill—and therefore it may enhance patient outcomes to ensure that ATs are well equipped to do so safely and effectively.

Additionally, these data reflect that although most ATs will perform at least 1 reduction (if not multiple reductions) in their clinical careers, the task is performed relatively infrequently compared with patient care skills that may be performed daily, weekly, or even monthly. This infrequent use may have implications for both the acquisition and maintenance of closed reduction knowledge and skills. Given the potential for infrequent use, training should likely be refreshed at appropriate intervals. Future researchers should investigate appropriate training and frequency.

Joints Reduced by ATs

The ATs reported performing reductions with and without a physician present. In both instances, the 3 most common reductions (shoulder, finger interphalangeal joint, and patella) were the same, although the order differed slightly (Figures 3 and 4). Our finding of the 3 most common reductions aligns with past injury-surveillance research,¹ in which the authors demonstrated the incidence of dislocations was highest in these body areas. Respondents communicated that, on average, they were *very comfortable* to *somewhat comfortable* performing reductions of these joints even without a physician present (Table 4).

Table 5. Athletic Trainers' Knowledge of Standing Orders and State Practice Acts Related to Joint Reductions

Question	Total, n	n (%)		
		Yes	No	Not Sure
Do you currently have written standing orders from your supervising physician regarding joint reductions?	772	269 (34.8)	273 (35.4)	230 (29.8)
If yes, do your written standing orders permit you as an athletic trainer to perform joint reductions when the physician is not present?	269	240 (89.2)	9 (3.3)	20 (7.4)
Do you currently have oral standing orders from your supervising physician regarding joint reductions?	772	444 (57.5)	152 (19.7)	176 (22.8)
If yes, do your oral standing orders permit you as an athletic trainer to perform joint reductions when a physician is not present?	441	396 (89.8)	12 (2.7)	33 (7.5)
To your knowledge, does your state practice act directly address whether ATs [athletic trainers] are permitted to perform joint reductions without a physician present?	772	59 (7.6)	247 (32.0)	466 (60.4)
If yes, to your knowledge, are athletic trainers permitted by your state practice act to perform joint reductions without a physician present?	59	35 (59.3)	15 (25.4)	9 (15.3)

Table 6. Relationship Between Frequency of Joint Reduction and Selected Demographic Factors

Demographic Factor	Frequency of Joint Reduction ^a			χ^2 Value	df	P Value
	High	Low	Never			
Clinical setting				20.639	6	.002
University or college	64	235	62			
Secondary school	91 ^b	227	46			
Professional sports	1	19	9			
Other	4	8	6			
Route to BOC certification in participants certified 0–15 y				8.189	2	.017
Accredited undergraduate program	65 ^c	239	93			
Accredited master's program	25 ^b	43	16			
Route to BOC certification in participants certified >15 y				4.470	4	.346
Internship	44	105	7			
Accredited undergraduate program	21	90	6			
Accredited master's program	3	9	0			
No. of years certified				71.307	10	<.001
0–5	57	158 ^c	88 ^b			
6–10	23	90	17			
11–15	11	36	4			
16–20	22	59	7			
21–25	18	55	3 ^c			
>25	29	91	4 ^c			
Gender				9.995	4	.041
Male	85	239	48			
Female	72	238	75 ^b			
Other	3	12	0			

Abbreviation: BOC, Board of Certification.

^a Frequency of joint-reduction categories was defined as *high* (daily, weekly, monthly, or every couple of months), *low* (yearly or less than once a year), or *never*.

^b Post hoc testing revealed that the observed frequency was higher than expected.

^c Post hoc testing revealed that the observed frequency was lower than expected.

Table 7. Relationship Between Frequency of Joint Reduction and Selected Situational Factors

Situational Factor	Frequency of Joint Reduction ^a			χ^2 Value	df	P Value
	High	Low	Never			
Estimated delay in care from athletic training facility to arrival at emergency department, min				20.616	6	.002
0–15	60	219	77 ^b			
16–30	71	193	32 ^c			
31–45	21	45	9			
>45	8	32	5			
Estimated wait from arrival at emergency room to receiving care, min				17.472	4	.002
0–30	37	118	53 ^b			
31–60	58	201	41			
>60	36	93	17			
Received joint reduction training as part of entry-level education?				15.696	4	.003
Yes	82	238	39 ^c			
No	67	194	67 ^b			
Unsure	11	57	17			
Have written standing orders regarding joint reductions?				25.703	4	<.001
Yes	71 ^b	173	25 ^c			
No	54	157	62 ^b			
Unsure	35	159	36			
Have oral standing orders regarding joint reductions?				82.831	4	<.001
Yes	117 ^b	299	28 ^c			
No	24	80 ^c	48 ^b			
Unsure	19 ^c	110	47 ^b			
State practice act directly addresses joint reductions?				5.658	4	.226
Yes	17	31	11			
No	56	157	34			
Unsure	87	301	78			

^a Frequency of joint-reduction categories was defined as *high* (daily, weekly, monthly, or every couple of months), *low* (yearly or less than once a year), or *never*.

^b Post hoc testing revealed that the observed frequency was higher than expected.

^c Post hoc testing revealed that the observed frequency was lower than expected.

The variety of joint reductions an AT participated in increased when a physician was present. This result makes sense, as an AT might assist a physician in a joint reduction that he or she would not otherwise feel comfortable performing alone. On average, ATs reported feeling *somewhat uncomfortable* to *very uncomfortable* performing reductions of the elbow, ankle, knee, or hip without a physician present (Table 4).

To our knowledge, no universal consensus exists regarding the types of joint reductions that are appropriate for ATs to perform without direct physician supervision. The 3 types of dislocations we identified as most often performed by ATs were the same 3 that Wright et al⁹ indicated were most often deemed acceptable for on-site performance by an AT. This consistency may be due to perceptions of the relatively low risk of performing these 3 reductions (both in relation to legal liability and poor patient outcomes).⁹ The NATA position statement⁶ noted that under appropriate circumstances, an AT can reduce or attempt to reduce the following joints: femoroacetabular, tibiofemoral, patellofemoral, metatarsophalangeal, interphalangeal of the fingers and toes, metacarpophalangeal, and glenohumeral. This list includes several reductions that ATs in the current study reported feeling *moderately uncomfortable* or *very uncomfortable* performing. The lack of comfort with closed reductions of these joints should be addressed with training before ATs incorporate these skills into their clinical practice. The NATA position statement⁶ also stated that ATs should not attempt to reduce the humeroulnar or proximal radioulnar joint on-site in most cases; reductions of the talocrural joint and radiocarpal joint were not directly addressed. Clarity from professional organizations or governing bodies on the types of joint reductions and techniques for joint reductions that are appropriate for an AT might help focus future education and training interventions to enhance AT competence and patient outcomes.

Education and Training

The NATA position statement⁶ recommended that physicians approve standing orders for closed joint reduction only for ATs with verifiable education, training, and skills. Therefore, we were curious about the most frequent methods by which ATs learned appropriate joint-reduction procedures or techniques. It was comforting that only a very small portion of ATs (2.8%) admitted receiving no training whatsoever on the topic. However, considering that most ATs (89.9%) said they performed reductions, it was mildly concerning that only 35% acknowledged receiving formal training in appropriate joint-reduction procedures or techniques as part of their entry-level education. Although entry-level education is not the only source of verifiable training, it is perhaps the most standardized and quality controlled due to accreditor oversight. Because joint reductions were not required in the entry-level curriculum until July 2020, it is not surprising that so few individuals received entry-level training. With the implementation of the new Commission on Accreditation of Athletic Training Education standards that require delivery and assessment of this content by July 2020,⁷ ATs graduating after the update should have a base level of joint-reduction knowledge and skills. These

skills should be verified by the AT's supervising physician before he or she implements closed reductions in clinical practice.

The survey revealed that most ATs had some postprofessional training, ranging from informal (eg, reading about the topic) to structured (eg, part of a continuing education unit or postprofessional course). The most common learning methods were receiving hands-on clinical training from a physician (64.0%), preceptor (41.3%), or other colleague (37.4) or reading about joint reduction (47.3%). The high frequency of hands-on training from a physician may be a positive finding, as it is best practice for a physician to verify an AT's skills before providing a standing order permitting joint reduction.⁶ Establishing a strong trusting relationship with the supervising physician may facilitate the creation of standing orders for joint reductions.

Recommendations regarding appropriate joint-reduction policies typically either contraindicate or strongly caution against performing on-site joint reductions in young children (due to open growth plates) and elderly patients (due to increased stiffness of bones) in the absence of available radiography.^{6,9} Our ATs largely complied with those recommendations; only a very small percentage of ATs ($\leq 2.5\%$) reported ever reducing a joint dislocation in either of these populations. However, few ATs in this study worked in clinical settings that would include either age group.

For the most part, we did not assess the participants' knowledge of appropriate joint-reduction policies and procedures or specific joint-reduction techniques. Therefore, we cannot determine the relative efficacy of any training method. Also, it is unclear if the relatively low level of involvement in activities such as continuing education events and workshops on joint reductions (22.4%) was due to a lack of opportunity, lack of interest, or other reasons. Lastly, also unclear were the level of competency of the average participant and areas in need of training. Future researchers should develop a valid tool for assessing ATs' joint-reduction competency.

State Practice Acts and Standing Orders

Athletic trainers should perform an on-site closed joint reduction only if such action is permitted by their state practice act and authorized by their supervising physician in standing orders.⁶ Therefore, it was interesting to measure the frequency of compliance with these recommendations (Table 6). We were surprised by the number of ATs who were uncertain if they had either oral or written standing orders related to joint reductions. Of those who had either oral or written standing orders, approximately 89% to 90% had permission to perform closed joint reductions without the physician present. Fewer than 4% of ATs indicated that their standing orders prohibited on-site closed joint reductions. These data appeared to show that the ATs largely had support from their supervising physicians to perform closed joint reductions. We did not ask for details about the standing orders, such as which joints the AT was permitted to reduce or which circumstances were considered acceptable. Future investigators should evaluate the nuances of standing orders.

Not surprising but potentially concerning was the relative rarity of written standing orders related to joint reductions (34.8% of all ATs). Although written standing orders are recommended over oral standing orders, writing legally acceptable standing orders may be difficult for the average clinician without a legal background. Perhaps due to legal liability concerns or the proprietary nature of these documents, we were unable to obtain any applicable example of athletic training standing orders in an extensive internet search. Difficulty obtaining appropriate examples may be one barrier to creating and adopting written standing orders in ATs' practices. Sample standing orders may be a resource worthy of development by an athletic training professional organization.

In the United States, athletic training regulation and practice acts vary from state to state. All ATs should be familiar with the practice act in their state to maintain compliance. State practice acts can include both broad and specific provisions regarding permitted or prohibited services. The use of broad language can be helpful in covering the wide scope of practice and possible services performed. However, broad language may also lead to a lack of clarity on specific topics (such as joint reductions). Most participants (60.4%) reported they were not sure if their state practice act addressed joint dislocations. Although one explanation is that ATs were not sufficiently familiar with their state practice acts, we believe that the confusion was more likely due to broad or unclear language in the practice act. For example, the Washington state practice act did not mention reductions or dislocations by name but did authorize ATs to provide "Immediate care of athletic injuries, including emergency medical situations through the application of first-aid and emergency procedures and techniques for non-life-threatening or life-threatening athletic injuries."¹⁹ One interpretation is that an onsite joint reduction is a technique for non-life-threatening athletic injury permitted by this definition; however, interpretation does not inspire the same confidence as direct guidance. The lack of direct guidance from states may lead to confusion. Anecdotally, we have heard from ATs who described relying on national standards and common practice because their state guidance was unclear.

Characteristics Associated With Unsupervised Joint Reduction by an AT

A secondary aim of our study was to identify factors significantly associated with either a high frequency of performing or never performing joint reductions. To target this aim, we tested for an association between self-reported frequency of performing a joint reduction and selected demographic and situational variables. We hypothesized that these variables might partially explain the reported clinical practice patterns, which in turn might provide insight or direction for future professional development and research.

Four factors that were associated with a higher frequency of joint reductions were clinical practice in the secondary school setting, being certified through a master's level professional program (in individuals certified 0–15 years), and having written or oral standing orders regarding joint reductions. We found it interesting

that clinical practice in the secondary school setting was associated with such a high frequency of ATs having performed reductions, considering that the patients were minors and may have had open growth plates (a significant concern when considering a closed joint reduction).^{6,10} Secondary schools are traditionally less likely to have a physician on-site than are university or professional sports, and thus, secondary school ATs may have more opportunities to perform unsupervised joint reductions than those in other settings.

The 8 factors associated with a lower likelihood of ever performing a reduction were not having received joint-reduction training as part of entry-level education, being certified via an accredited undergraduate program (in individuals certified 0–15 years), having been only recently certified (0–5 years), being female, estimating a short delay in care from the athletic training facility to arrival at the emergency department, estimating a short wait from arrival at the emergency department to receiving care, and not having written or standing orders regarding joint reductions. It may be a sign of professionalism that those ATs without training or without standing orders were less likely to ever perform reductions. Past researchers^{2,3,6} have reported higher relocation success rates and moderate evidence of improved patient comfort, joint integrity, and functional prognosis with early reduction. Thus, we hypothesized that ATs who expected longer delays in care would be more likely to attempt on-site reduction, and conversely, ATs with rapid access to emergency care would reduce at a lower frequency. This hypothesis was partially supported by the finding that ATs with short estimated care delays were less likely to reduce. As the most common frequency of joint reduction was less than once per year, we were not surprised that recently certified ATs were less likely to have performed a reduction. It is likely that some individuals in this category had not yet encountered a situation in which an on-site joint reduction would have been an appropriate action. The reason behind the observed gender difference in joint-reduction frequency cannot be determined using the current study design. We included this demographic variable because gender differences in clinical behaviors have been noted in physicians.^{20,21} Future authors should explore potential explanations for the observed gender differences in joint-reduction frequency so that instructors can address unique learner needs.

Clinical Implications

One hope we have for this study is that understanding current practice patterns may help shape future training, resources, and research that will in turn affect future clinical practice. One clinical implication of the current findings is to corroborate the results of previous researchers⁹ who indicated that ATs considering adding joint reductions to their clinical practice would be well advised to start with the glenohumeral, patellofemoral, and interphalangeal joints. Here, we identified a need to develop closed joint-reduction training and resources (such as sample written standing orders) appropriate for the scope of practice of an AT. Additionally, a clinical implication of the relatively rare frequency of joint reduction is the need for repeated skills refreshers (similar to those for cardio-

pulmonary resuscitation training or spine-boarding practice) if the AT wants to ensure the best patient care. Earlier investigators^{17,18} who studied physicians looked at factors that influenced joint-reduction behaviors and success. We also identified factors that influenced joint-reduction behaviors, such as experience, training, and estimated referral times. Clinical decision making is complex, and understanding factors that influence clinical decision making may enhance patient care.

Limitations

The final response rate of this survey was lower than desired. However, it was in line with NATA norms for its survey distribution service. The survey became available at approximately the same time as COVID-19 was declared a global pandemic, which may have affected the response rate. Anticipating a potential low response rate, we purposely oversampled to obtain a sufficient number of participants—which we believe was achieved. Our sample population approximated the April 2020 NATA membership statistics for gender and district, providing further evidence of a representative sample.²²

We developed the survey instrument (Appendix) for this study, and it has yet to be validated by other experts. It was designed by 2 ATs, 1 with significant clinical experience and another with significant research experience; pilot tested by 7 ATs; and then revised based on pilot participant feedback and investigator review of the pilot responses. We believe this process led to clear questions with appropriate response options. However, we acknowledge that the lack of validity or reliability data is a limitation and encourage readers to assess the survey instrument for themselves.

CONCLUSIONS

Joint dislocations constitute a small but important percentage of all athletic injuries.¹ Initial management of joint dislocations often falls to ATs, including performance of on-site closed joint reductions. Most ATs (90%) performed on-site joint reductions, although the frequency of performing reductions was typically low and varied by joint and whether a physician was present. Education of ATs regarding appropriate joint-reduction procedures has been inconsistent, and not all ATs had standing orders to perform reductions. The frequency of performing joint reductions may be influenced by certain situational or demographic factors (eg, clinical setting, route to certification by the Board of Certification, estimated time for referral, and presence of standing orders). Based on how commonly ATs reported performing closed joint reductions, further development of joint-reduction knowledge and skills is warranted.

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Appendix. Survey^a

The purpose of this survey research is to investigate athletic trainers' clinical experience and background performing joint reductions to treat a dislocated joint. As joint reductions are integrated into entry-level professional program curriculum, we believe it is helpful to better understand the practice and experience of current athletic trainers.

1. Are you a certified athletic trainer by the BOC?
 - a. Yes [continue survey]
 - b. No [end survey]
2. Do you currently engage in direct patient care as an athletic trainer at least 20+ hours a week?
 - a. Yes [skip to question #4]
 - b. No [proceed to question #4]
3. Have you ever in your career engaged in direct patient care as an athletic trainer at least 20+ hours a week?
 - a. Yes [continue survey]
 - b. No [end survey]
4. Which of the following best describes the clinical setting where you provide direct patient care:
 - a. College/university
 - b. Secondary school
 - c. Therapy/rehabilitation clinic
 - d. Physician practice
 - e. Hospital
 - f. Professional sports
 - g. Occupational health
 - h. Amateur/recreational/youth sports
 - i. Military/law enforcement/government
 - j. Other, please describe
5. What route did you take to BOC certification?
 - a. Internship route
 - b. Accredited undergraduate athletic training program
 - c. Accredited master's level athletic training program
 - d. Other, please describe.
6. How many years have you been certified?
 - a. 0–5
 - b. 6–10
 - c. 11–15
 - d. 16–20
 - e. 21–25
 - f. Over 25 years
7. In your clinical practice, have you ever performed or assisted with any joint reduction while a physician was present?
 - a. Yes
 - b. No [skip to question #9]
8. Which of the following joint reductions have you performed or assisted while a physician was present? Select all that apply.
 - a. Shoulder (glenohumeral)
 - b. Elbow (humeroulnar or radioulnar)
 - c. Finger: interphalangeal joints
 - d. Finger: metacarpal-phalangeal joint
 - e. Hip (coxofemoral)
 - f. Knee (tibiofemoral)
 - g. Patella (patellofemoral)
 - h. Ankle (talocrural or subtalar)
 - i. Toes (interphalangeal)
 - j. Other, please describe
9. In your clinical practice, have you ever performed or assisted with any joint reduction while a physician was not present?
 - a. Yes
 - b. No [skip to question #15]
10. Which of the following joint reductions have you performed or assisted without a physician present? Select all that apply
 - a. Shoulder (glenohumeral)
 - b. Elbow (humeroulnar or radioulnar)
 - c. Finger: interphalangeal joints
 - d. Finger: metacarpal-phalangeal joint
 - e. Hip (coxofemoral)
 - f. Knee (tibiofemoral)
 - g. Patella (patellofemoral)
 - h. Ankle (talocrural or subtalar)
 - i. Toes (interphalangeal)
 - j. Other, please describe
11. In your clinical practice how frequently do you engage in any type of joint reduction without a physician present?
 - a. Daily
 - b. Weekly
 - c. Monthly
 - d. Every couple months
 - e. Yearly
 - f. Less than once a year
 - g. Other, please describe
12. In your career, approximately how many dislocations have you reduced without a physician present?
 - b. [Drop down list of numbers + not applicable option]
13. What are the 3 most common joint reductions you have performed or assisted without a physician present? Select up to 3.
 - a. Shoulder (glenohumeral)
 - b. Elbow (humeroulnar or radioulnar)
 - c. Finger: interphalangeal joints

- d. Finger: metacarpal-phalangeal joint
 - e. Hip (coxofemoral)
 - f. Knee (tibiofemoral)
 - g. Patella (patellofemoral)
 - h. Ankle (talocrural or subtalar)
 - i. Toes (interphalangeal)
 - j. Other, please describe
14. In your clinical practice have you ever performed a joint reduction on any of the following patient populations without a physician present. Please select all that apply.
- a. Child (<13)
 - b. Adolescent (13–18)
 - c. Adult (18–54)
 - d. Senior/geriatric (55+)
- Please use this scenario to answer the following 2 questions: In your most recent clinical setting, imagine you chose not to reduce a dislocated joint and instead refer your patient to the closest hospital emergency department for care.
15. How long of a delay in care from transportation time would you estimate (eg, the time between leaving your facility until arriving at the emergency department)?
- a. 0–15 minutes
 - b. 16–30 minutes
 - c. 31–45 minutes
 - d. 46–60 minutes
 - e. >60 minutes
16. How long of a delay in care would you estimate in the waiting room (eg, the time between arriving at the emergency department and actually receiving care)?
- a. 0–15 minutes
 - b. 16–30 minutes
 - c. 31–45 minutes
 - d. 46–60 minutes
 - e. 61–75 minutes
 - f. 76–90 minutes
 - g. >90 minutes
17. For each type of joint dislocation, please indicate how comfortable are you with performing on-site joint reduction (eg, on-the-field or in an AT facility) without a physician present.
18. Were you taught appropriate joint reduction techniques as part of your precertification athletic training curriculum/program?
- a. Yes
 - b. No
 - c. I'm not sure
19. Which of the following methods have you utilized to learn about appropriate joint reduction procedures and techniques? Select all that apply.
- a. Part of a course during your entry-level professional education
 - b. Part of a course during postprofessional/advanced education
 - c. Completed workshop/CEU course
 - d. Read about joint reduction (eg, articles, textbook)
 - e. Received hands-on/clinical training from physician
 - f. Received hands-on/clinical training from preceptor
 - g. Received hands-on/clinical training from colleague
 - h. None of the above
 - i. Other
20. Do you currently have written standing orders from your supervising physician regarding joint reductions?
- a. Yes
 - b. No [skip to question #22]
 - c. I'm not sure [skip to question #22]
21. [if yes #20] Do your written standing orders permit you as an athletic trainer to perform joint reductions when the physician is not present?
- a. Yes
 - b. No
22. Do you currently have oral standing orders from your supervising physician regarding joint reductions?
- a. Yes
 - b. No [skip to question #24]
 - c. I'm not sure [skip to question #24]
23. [if yes #22] Do your oral standing orders permit you as an athletic trainer to perform joint reductions when a physician is not present?
- a. Yes
 - b. No
 - c. I'm not sure
24. To your knowledge, does your state practice act directly address whether ATs are permitted to perform joint reductions without a physician present?

Type of Dislocation	Very Comfortable	Somewhat Comfortable	Neither Comfortable nor Uncomfortable	Somewhat Uncomfortable	Very Uncomfortable
Shoulder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Elbow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finger interphalangeal joints	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finger metacarpal-phalangeal joint	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hip (coxofemoral)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knee (tibiofemoral)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Patella (patellofemoral)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ankle (talocrural or subtalar)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Toes (interphalangeal)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- a. Yes, joint reductions are directly addressed in the practice act
 - b. No, joint reductions aren't directly addressed in the practice act [skip to question #26]
 - c. I'm not sure [skip to question #26]
25. [if yes #24] To your knowledge, are athletic trainers permitted by your state practice act to perform joint reductions without a physician present?
- a. Yes
 - b. No
 - c. I'm not sure

Almost done, just 3 quick demographic questions and you are finished!

26. Please select the primary state in which you practice AT.
- a. [Dropdown list of all 50 states + Washington DC, US territory, and Other]
27. Please indicate your age range
- a. 30 or under
 - b. 31–40
 - c. 41–50
 - d. 51–60
 - e. 61–70
 - f. Over 70
28. Please indicate your gender
- a. Male
 - b. Female
 - c. Transgender
 - d. Prefer not to disclose
 - e. Self-identity, please describe.

^a Instrument is presented in its original format.