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Concussion Assessment and Management Practices Among Irish and Canadian Athletic Therapists: An International Perspective

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Context: Certified athletic therapists in Ireland and Canada serve essential concussion assessment and management roles, but their health care practices and concussion knowledge have not been established.

Objective: To examine Irish and Canadian athletic therapist cohorts' (1) concussion knowledge, (2) current concussion assessment and management techniques across all job settings, and (3) the association of concussion assessment and management practices with years of clinical experience and highest degree attained.

Design: Cross-sectional cohort study.

Setting: Online survey.

Patients or Other Participants: Licensed Irish (49.7%, n = 91/183) and Canadian (10.1%, n = 211/2090) athletic therapists.

Main Outcome Measure(s): Athletic therapists completed an online survey assessing their demographics, concussion knowledge (symptom recognition, patient–clinician scenarios), frequency of concussions assessed annually, and assessment and return-to-play (RTP) measures using a modified, previously validated survey. Symptom recognition consisted of 20 (8 true, 12 false) items on recognition of signs and symptoms that were scored as total correct. Descriptive statistics and odds ratios were used to examine survey responses where appropriate.

Results: Irish (86.8%, n = 46/53) and Canadian (93.4%, n = 155/166) athletic therapists indicated RTP guidelines were the most common method for determining RTP. Symptom recognition scores were 72.8% ± 17.0% among Irish and 76.6% ± 17.0% among Canadian athletic therapists. Irish (91.2%, n = 52/57) and Canadian (90.4%, n = 161/178) athletic therapists reported standardized sideline assessments as the most used concussion assessment method. Irish and Canadian athletic therapists' use of 2-domain (Irish: 38.6% [n = 22/57]; Canadian: 73.6% [n = 131/178]) and 3-domain (Irish: 3.5% [n = 2/57]; Canadian: 19.7% [n = 35/178]) minimum assessments (ie, symptoms, balance, or neurocognitive) was not associated with education or clinical experience ($P \geq .07$), except for Canadian athletic therapists with master's degrees having greater odds of completing 2-domain assessments at initial evaluation than those with bachelor's degrees (odds ratio = 1.80; 95% CI = 1.41, 1.95).

Conclusions: Irish and Canadian athletic therapists demonstrated similar concussion knowledge; however, most did not fully adhere to international consensus guidelines for concussion assessment as evidenced by low 2- and 3-domain assessment use. Athletic therapists should aim to implement multidimensional concussion assessments to ensure optimal health care practices and patient safety.

Key Words: mild traumatic brain injury, sports medicine, evaluation, diagnosis

Key Points

- Both Irish and Canadian athletic therapists displayed similar symptom recognition and overall proper patient–clinician scenario responses, suggesting similar concussion knowledge was present.
- Irish and Canadian athletic therapists frequently used symptom checklists and balance assessments in clinical practice, but neurocognitive testing was infrequently used, which may be partially attributed to resource barriers.
- Individual assessments were rarely used in combination (ie, multidimensional assessment), marking an area for clinical improvement among Irish and Canadian athletic therapists.

Certified athletic therapists serve a vital role in concussion assessment and management. Athletic therapists are among the few health care providers pitchside and often the first to assess patients with concussions, guide rehabilitation, and monitor return-to-play (RTP) decision making. Therefore, it is vital for athletic therapists to remain current with evidence-based concussion assessment and management guidelines and to continually improve their concussion recognition capabilities.

Present international consensus guidelines for assessing and managing sport-related concussions call for a multimodal evaluation of signs and symptoms, balance, and cognitive function at minimum.[1] In accordance with these recommended best practices, the Irish (Athletic Rehabilitation Therapy Ireland [ARTI]) and Canadian (Canadian Athletic Therapists Association [CATA]) professional athletic therapist associations include concussion recognition and management in their scopes of practice and credentialing examinations. Concussion knowledge is a critical consideration for optimal clinical care.[1] Suboptimal recognition of concussion signs and symptoms among health care providers, for example, may lead to an unrecognized concussion and a premature RTP decision. Premature RTP after concussion has been associated with prolonged recovery times and further highlights the necessity of concussion recognition.[2,3] Symptom inventories have the strongest diagnostic accuracy for concussion, emphasizing the vital role symptom recognition plays in clinical care.[4–6] However, concussion knowledge assessments (ie, symptom recognition) and practice examinations among Irish and Canadian athletic therapists have yet to be conducted.

Irish and Canadian athletic therapists serve roles similar to those of American athletic trainers, as evidenced by international agreements among all 3 national organizations recognizing one another's professional qualifications and standards.[7] Concussion practices among American athletic trainers have been well documented over the past 2 decades and have demonstrated the growing importance and improved the quality of concussion health care.[8–12] Although similar, important differences exist between American athletic trainers and Irish and Canadian athletic therapists regarding health care access, governing laws, scopes of practice, patient populations, and cultures. Examining athletic therapists' concussion health care practices can help establish a benchmark for the profession, identify strengths and weaknesses, and recognize areas for targeted education to potentially improve concussion health care practices globally. Unlike American athletic trainers, Irish and Canadian athletic therapists do not have to practice under a directing physician or need standing orders for concussion health care, and they have direct, nonreferral access to patients and can practice independently through an existing medical system or their own private practice because of their scopes of practice. In the United States, all 50 states and the District of Columbia have legislation directing concussion health care.[13] In comparison, no legislation exists in Ireland for RTP decision making, and only 1 province (Ontario) in Canada has legislation directing RTP[14]; other Canadian provinces have guidelines not entrenched in legislation. Clear differences exist between the governing requirements and the scopes of practices of American athletic trainers and Irish and Canadian athletic therapists surrounding concussion, highlighting the importance of evaluating athletic therapists from each country.

The purpose of our study was to examine (1) concussion knowledge, (2) current concussion assessment and management techniques across all job settings, and (3) if practices differed based on factors such as years of clinical experience and academic degrees attained by Irish and Canadian athletic therapists. Given previous research findings,[8,15] we hypothesized that Irish and Canadian athletic therapists (1) would display similar concussion knowledge as American athletic trainers[15] and (2) would partially meet international consensus guidelines for concussion assessment and management, and (3) with more years of clinical experience and higher education degrees would have greater odds of using multiple clinical assessment domains.

METHODS

Participants

Athletic therapists in Ireland and Canada who were members of ARTI and the CATA, respectively, were invited to participate in this online, cross-sectional cohort survey study. Membership in these organizations is required by Canada and Ireland to obtain licensure as an athletic therapist and was the sole inclusion criterion for this study. A total of 183 Irish athletic therapists (N. Taaffe, ARTI, written communication, April 2021) and 2090 Canadian athletic therapists (H. DeFazio, CATA, written communication, April 2021) were licensed and eligible to participate at the time of survey distribution. All respondents provided informed consent before starting the survey, and this study was deemed exempt by the Institutional Review Board of the University of Georgia.

Procedures

The survey was administered separately to the ARTI and CATA memberships in February 2021. Each organization sent emails to its members containing a cover letter, an informed consent form, and a web link to complete the online survey from a computer or mobile device. Invitations to participate were also included in each organization's periodical newsletter. Follow-up communications were sent to the memberships at 3 and 6 weeks after the initial survey date, regardless of whether participants had completed the survey.[8,15,16] The survey allowed for only 1 attempt per participant to ensure survey response independence, and all survey items were optional. The survey was active for a total of 8 weeks, and all partially completed surveys were recorded.

Instrumentation

Anonymous web-based surveys were directly adapted from a previously established survey[8,15,16] for Irish and Canadian athletic therapists using an online survey tool (Qualtrics). The survey took 20 minutes on average to complete. Responses to survey items consisted of "Select all that apply," multiple choice, open-ended, and short-answer item options. Slight changes to the survey were necessary to account for differences in terminology and practice settings between countries to ensure valid survey responses.[8,15,16] We assessed content validity of the surveys to ensure appropriate item construct(s) and clarity. Next, the surveys were piloted among Irish (n = 5) and Canadian

(n = 5) athletic therapist colleagues to ensure online survey function and collect open-ended survey feedback. The final survey was then revised based on their feedback and subsequently distributed.

The survey domains consisted of athletic therapists' training and practice backgrounds (degrees earned, years certified as an athletic therapist, years of clinical experience, and employment settings), descriptive data related to concussions sustained and their characteristics for each participant's patient population, clinical methods used to assess and determine RTP after concussion, and concussion knowledge using patient–clinician scenarios and signs and symptoms recognition.[8,15,16] Patient-clinician scenarios consisted of items such as, "If a player reported postconcussion symptoms but appeared normal on standardized methods of concussion (eg, Standardized Assessment of Concussion [SAC], Balance Error Scoring System [BESS], neurocognitive testing), would the athlete be allowed to return to play at your institution?" The signs and symptoms recognition section was drawn from a reliable, valid, and earlier published survey consisting of 20 items (8 true, 12 false) asking athletic therapists to indicate whether the listed sign or symptom was associated with a concussion.[15,17] Survey items are presented in Tables 1–4.

Data Analyses

We examined Irish and Canadian survey responses separately. Some individuals (<0.01% in both cohorts) created a range or fraction of the number of concussions occurring in each sport. In these cases, the range midpoint was determined and used. Frequencies and proportions were calculated for all survey responses. Survey items had various participant response rates, which did not sum to the total sample size because participants were allowed to skip individual survey items or discontinue the survey at any time. Descriptive statistics were calculated for responses to athletic therapists' training and practice backgrounds, patient–clinician scenarios, and signs and symptoms recognition items. Responses to signs and symptoms recognition items were transformed into composite scores by summing the number of correct items and dividing by the total number of items on the measure (n = 20), resulting in a percentage correct score.[15,18,19]

Univariable, binary logistic regression models were fit to calculate the odds ratios (ORs) with 95% CIs of using a 2-domain ($\geq$2 of symptom checklist, balance assessment, or neurocognitive assessments) and 3-domain assessment (all 3 assessments) for injury assessment and RTP decision making separately between education (bachelor's versus master's degree) and years of clinical experience (4 total models).[8] Primary work setting was not examined because Canadian and Irish athletic therapists often work in >1 setting by default (eg, working 50% in a clinic setting and 50% in a secondary sport).[8] All ORs with 95% CIs not including 1.0 were considered different. We completed all analyses using The R Project for Statistical Programming (version 3.4.3; The R Foundation)[20] with the α level set *a priori* at .05.

RESULTS

A substantial proportion of all Irish (49.7%, n = 91/183) and Canadian (10.1%, n = 211/2090) athletic therapists initiated the online surveys and met the inclusion criteria. Among those who initiated the survey, 48 (52.7%) Irish and 159 (75.4%) Canadian athletic therapists completed >90% of their prompted survey items, with 48 Irish and 156 Canadian athletic therapists completing the concussion knowledge section. Degrees earned, total years of certification and clinical experience, primary work setting, current practice status, and sport medicine care coverage data are provided in Table 1. The frequencies of concussions diagnosed annually by Irish and Canadian athletic therapists across sports, including their initial presentation and recovery patterns, are presented in Table 2.

Concussion Knowledge

Irish athletic therapists (n = 48) had a mean signs and symptoms recognition score of 72.8% ± 17.0% (median = 70.0%; range = 40.0%–100%; Table 3). They were most familiar with sport-specific RTP guidelines, with 97.9% (47/48) familiar with the Irish Rugby Football Union guidelines,[21] followed by 68.8% (33/48) with the 2016 Berlin "Consensus Statement on Concussion in Sport"[1] and 54.2% (26/48) with the 2012 Zurich "Consensus Statement on Concussion in Sport."[22]

Canadian athletic therapists (n = 156) had a mean signs and symptoms recognition score of 76.6% ± 17.0% (median = 80.0%; range = 35.0%–100%; Table 3). Approximately 80.9% (123/152) of them were most familiar with the 2017 "Canadian Guideline on Concussion in Sport,"[23] followed by 75.7% (115/152) with the 2016 Berlin "Consensus Statement on Concussion in Sport,"[1] and 75.0% (114/152) with the 2012 Zurich "Consensus Statement on Concussion in Sport."[22] The patient–clinician scenario results for both Irish and Canadian athletic therapists are shown in Table 4.

Initial Concussion Assessment

Individual instrument proportions within each concussion assessment domain among Irish and Canadian athletic therapists are depicted in Figure 1. A 3-domain minimum concussion assessment was indicated by 3.5% (2/57) of Irish athletic therapists, and a 2-domain minimum assessment was indicated by 38.6% (22/57; Figure 2). A 3-domain minimum concussion assessment was selected by 19.7% (35/178) of Canadian athletic therapists, and a 2-domain minimum assessment was selected by 73.6% (131/178).

Concussion Management and RTP

Methods for determining RTP are presented in Figure 1E. A 3-domain concussion assessment was indicated by 1.9% (1/53) of Irish athletic therapists when determining RTP, and a 2-domain concussion assessment was specified by 34.0% (18/53). The athletic therapist was chosen by 73.1% (38/52) of Irish athletic therapists as being *primarily responsible* for RTP decision making, followed by 15.4% (8/52) who named the team physician. They indicated the player was primarily responsible for final RTP decisions in 5.8% of cases (3/52).

A 3-domain concussion assessment was selected by 9.6% (16/166) of Canadian athletic therapists when determining RTP, and a 2-domain concussion assessment was specified by 50.0% (83/166). The athletic therapist was cited by 37.2% (61/164) of Canadian athletic therapists as being

Table 1. Athletic Therapists' Training and Practice Backgrounds[a]

Characteristic	Athletic Therapists	
	Irish (n = 91)	Canadian (n = 211)
	Frequency (%)	
Degree (select all that apply)		
Bachelor's	81 (89.0)	191 (90.1)
Master's	27 (29.7)	45 (21.2)
Clinical doctorate	0 (0.0)	0 (0.0)
Doctor of Philosophy or Education	2 (2.2)	7 (3.3)
Medical doctor	0 (0.0)	0 (0.0)
Work clinically		
Yes	63 (69.2)	187 (88.2)
No	23 (25.3)	23 (10.8)
Primary work setting		
Academic department (education or faculty)	9 (9.9)	8 (3.8)
Club athletics or sports	24 (26.4)	3 (1.4)
Collegiate athletics or sports	4 (4.4)	39 (18.4)
Corporate health	0 (0.0)	2 (0.9)
Fitness center	0 (0.0)	7 (3.3)
General hospital setting	1 (1.1)	4 (1.9)
High school athletics	0 (0.0)	19 (9.0)
Industrial setting	0 (0.0)	4 (1.9)
Medical sales	0 (0.0)	6 (2.8)
Own private practice	28 (30.8)	17 (8.0)
Personal trainer	0 (0.0)	3 (1.4)
Professional athletics or sports	4 (4.4)	10 (4.7)
Sports medicine clinic	5 (5.5)	66 (31.1)
Other	5 (5.5)	15 (7.1)
Sports medicine care	81 (89.0)	177 (83.5)
Men's sports (select all that apply)		
American football	0 (0.0)	67 (37.9)
Baseball	0 (0.0)	22 (12.4)
Basketball	6 (7.4)	62 (35.0)
Gaelic football	51 (63.0)	0 (0.0)
Hurling	37 (45.7)	0 (0.0)
Ice hockey	0 (0.0)	88 (49.7)
Lacrosse	0 (0.0)	21 (11.9)
Rugby	18 (22.2)	43 (24.3)
Soccer	18 (22.2)	69 (39.0)
Track and field	0 (0.0)	24 (13.6)
Volleyball	1 (1.2)	39 (22.0)
Wrestling	0 (0.0)	19 (10.7)
Other	4 (4.9)	25 (14.1)
Women's sports (select all that apply)		
Basketball	3 (3.7)	61 (34.5)
Camogie	19 (23.5)	0 (0.0)
Field hockey	0 (0.0)	12 (6.8)
Gymnastics	0 (0.0)	7 (4.0)
Ice hockey	2 (2.5)	41 (23.2)
Lacrosse	0 (0.0)	9 (5.1)
Ladies Gaelic football	37 (45.7)	0 (0.0)
Rowing	0 (0.0)	2 (1.1)
Rugby	8 (9.9)	48 (27.1)
Soccer	12 (14.8)	62 (35.0)
Softball	0 (0.0)	12 (6.8)
Track and field	0 (0.0)	21 (11.9)
Volleyball	0 (0.0)	45 (25.4)
Other	2 (2.5)	30 (16.9)
	Mean ± SD	
Certification, y	6.4 ± 6.8	13.1 ± 8.5
Clinical experience, y	6.6 ± 4.5	12.6 ± 7.5
Time since working clinically, y	1.9 ± 1.0	2.7 ± 2.4

[a] Frequencies were reported relative to a specific survey item and do not reflect the total initial survey sample.

Table 2. Reported Concussion Characteristics Among Irish and Canadian Athletic Therapists

Variable	Athletic Therapists	
	Irish (n = 91)	Canadian (n = 211)
	Concussions observed annually, No.	
Total	228	2575
Mean ± SD	2.5 ± 5.7	12.2 ± 17.9
Median (range)	0.00 (0–31)	5.5 (0–162)
	Concussions medically documented, %	
Mean ± SD	87.3 ± 26.7	97.0 ± 12.9
Median (range)	100.0 (0–100)	100.0 (2–100)
	Frequency (%)	
Concussions involving loss of consciousness	104 (45.6)	122 (4.7)
Concussions involving retrograde or anterograde amnesia	134 (58.8)	415 (16.1)
Symptom resolution >10 d	156 (68.4)	693 (26.9)
Symptom resolution >6 wk	32 (14.0)	209 (8.1)
Return to play >10 d	225 (98.7)	1149 (44.6)
Return to play >6 wk	45 (19.7)	246 (9.6)
	Concussions per men's sport	
American football	0 (0.0)	491 (19.1)
Baseball	0 (0.0)	19 (0.7)
Basketball	1 (0.4)	109 (4.2)
Gaelic football	86 (37.7)	0 (0.0)
Hurling	27 (11.8)	0 (0.0)
Ice hockey	0 (0.0)	372 (14.4)
Lacrosse	0 (0.0)	48 (1.9)
Rugby	33 (14.5)	253 (9.8)
Soccer	11 (4.8)	135 (5.2)
Track and field	0 (0.0)	6 (0.2)
Volleyball	0 (0.0)	43 (1.7)
Wrestling	0 (0.0)	62 (2.4)
Other	0 (0.0)	64 (2.5)
	Concussions per women's sport	
Basketball	4 (1.8)	160 (6.2)
Camogie	5 (2.2)	0 (0.0)
Field hockey	0 (0.0)	19 (0.7)
Gymnastics	0 (0.0)	4 (0.2)
Ice hockey	0 (0.0)	173 (6.7)
Lacrosse	0 (0.0)	16 (0.6)
Ladies Gaelic football	32 (14.0)	0 (0.0)
Rowing	0 (0.0)	1 (0.0)
Rugby	18 (7.9)	252 (9.8)
Soccer	11 (4.8)	197 (7.7)
Softball	0 (0.0)	10 (0.4)
Track and field	0 (0.0)	6 (0.2)
Volleyball	0 (0.0)	68 (2.6)
Other	0 (0.0)	67 (2.6)

primarily responsible for RTP decision making, followed by 32.9% (54/164) who named the team physician and 17.1% (28/164) who chose a general physician. The coach and player were never selected as being primarily responsible for final RTP decisions.

Multidimensional Assessment Use By Level of Education and Clinical Experience

Among Irish athletic therapists, the odds of using a 2-domain minimum concussion assessment at initial evaluation and RTP, respectively, were not different between those with master's and bachelor's degrees (OR = 1.59; 95% CI = 0.44, 6.16; $P = .48$ and OR = 1.08; 95% CI = 0.30, 4.22; $P = .91$) or by years of clinical experience (OR = 0.98; 95% CI = 0.90, 1.06; $P = .65$ and OR = 0.95; 95% CI = 0.85, 1.03; $P = .24$). We did not generate models for 3-domain concussion assessments because of the low reported frequencies ($n \leq 2$).

Canadian athletic therapists with master's degrees had greater odds (OR = 1.80; 95% CI = 1.41, 1.95; $P = .01$) than those with bachelor's degrees of completing 2-domain minimum assessments at initial evaluation but not 3-domain assessments (OR = 1.47; 95% CI = 0.71, 2.22; $P = .15$). Their years of clinical experience were not associated with different odds of performing 2-domain (OR = 1.02; 95% CI = 0.97, 1.06; $P = .50$) or 3-domain (OR = 1.03; 95% CI = 0.99, 1.08; $P = .14$) concussion assessments at

Table 3. Survey Items and Responses for Signs and Symptoms Recognition

Please indicate which of the following you would consider to be a sign or symptom of concussion. (Correct response)[a]	Athletic Therapists	
	Irish (n = 48)	Canadian (n = 156)
	Correct Response Frequency (%)	
Abnormal sense of taste (false)	23 (47.9)	74 (47.4)
Abnormal sense of smell (false)	23 (47.9)	66 (42.3)
Amnesia (true)	48 (100.0)	156 (100.0)
Joint stiffness (false)	27 (56.3)	130 (83.3)
Blurred vision (true)	47 (97.9)	155 (99.4)
Black eye (false)	30 (62.5)	90 (57.7)
Bleeding from the ear (false)	17 (35.4)	63 (40.4)
Bleeding from the mouth (false)	35 (72.9)	118 (75.6)
Bleeding from the nose (false)	31 (64.6)	97 (62.2)
Confusion (true)	47 (97.9)	156 (100.0)
Fever (false)	36 (75.0)	143 (91.7)
Dizziness (true)	48 (100.0)	156 (100.0)
Headache (true)	48 (100.0)	155 (99.4)
Insomnia (true)	44 (91.7)	138 (88.5)
Loss of consciousness (true)	48 (100.0)	150 (96.2)
Nausea (true)	48 (100.0)	156 (100.0)
Numbness or tingling of arms (false)	20 (41.7)	75 (48.1)
Skin rash (false)	45 (93.8)	150 (96.2)
Sharp burning pain in neck (false)	19 (39.6)	90 (57.7)
Weakness in neck movements (false)	16 (33.3)	73 (46.8)
	Mean ± SD	
Signs and symptoms recognition, %	72.8 ± 17.0	76.6 ± 17.0

[a] Adapted.[17]

initial evaluation. In the RTP timeframe, no odds differences were observed for 2-domain (OR = 0.72; 95% CI = 0.33, 1.57; $P = .41$ and OR = 1.00; 95% CI = 0.97, 1.04; $P = .84$) or 3-domain (OR = 0.35; 95% CI = 0.11, 1.13; $P = .07$ and OR = 1.03; 95% CI = 0.97, 1.09; $P = .28$) concussion assessments for education or clinical experience, respectively, among Canadian athletic therapists.

DISCUSSION

Our study provides foundational insights into Irish and Canadian athletic therapists' concussion health care practices. These findings may be used to inform clinicians and athletic therapy education program stakeholders about the current state of concussion health care to bolster concussion-related management strengths and to address identified weaknesses. We discuss our findings in relation to the 5th International Consensus on Concussion in Sport consensus statement[1] and comparable evidence-based practices among American athletic trainers to identify areas for improvement and guidance for implementing changes.

Concussion Knowledge

We examined overall concussion knowledge among Irish and Canadian athletic therapists. Irish athletic therapists demonstrated 72.8% symptom recognition on average, whereas Canadian athletic therapists demonstrated 76.6% (Table 3). Previous researchers[15] using this symptom recognition survey determined that American athletic trainers correctly identified 78% of concussion signs and symptoms. Therefore, Irish and Canadian athletic therapists displayed comparable symptom recognition as American athletic trainers using the same measure. Importantly, symptom recognition items such as *bleeding from the ear* or *weakness in neck movements* (Table 3) had low frequencies of correct responses that may be attributed to instructions being misconstrued and participants identifying more severe traumatic brain injury symptoms. Although it is only 1 assessment component, the symptom checklist is the most sensitive concussion diagnostic assessment,[4–6] and therefore, clinicians should maintain their knowledge of concussion signs and symptoms to ensure recognition.

Irish and Canadian athletic therapists responded to the patient-clinician scenarios (Table 4) in accordance with current consensus guidelines overall.[1,24–27] However, 1 concerning finding was the high proportion of *yes* responses to item 3 in Table 4, which implies that athletes would be able to RTP if their clinical examination (eg, Glasgow Coma Scale, Maddocks questions, neurologic assessment) did not show abnormalities but the player stated, "I'm fine, I just got my bell rung." For this item, 58.3% and 39.5% of Irish and Canadian survey participants, respectively, responded *yes*. In comparison, approximately 46% of American athletic trainers earlier gave the same response.[15] Allowing individuals to RTP in the suggested context may result in prolonged recovery[2,3]; secondary injury; and rare yet catastrophic injury (ie, second impact syndrome).[28] Health care providers need to identify the colloquial "had my bell rung" as a descriptor for a transient moment of deficits in cognitive or motor function with or without the presence of symptoms and conduct a thorough multimodal assessment.[24]

Most patient–clinician scenario responses also yielded higher percentages of *yes* responses for scenarios asking athletic therapists if athletes would *be allowed* to RTP at their institution compared with the identical scenario specifying if athletic therapists *feel comfortable* (Table 4). The high proportions of *yes* responses to item 3 and the *be*

Table 4. Patient–Clinician Scenario Results

Survey Item[a]	Athletic Therapists			
	Irish		Canadian	
	Yes Frequency Response	Total Responses per Item (%)	*Yes* Frequency Response	Total Responses per Item (%)
(1) If your clinical examination revealed abnormalities, but the player appeared normal on standardized methods of concussion assessment (eg, SAC, BESS, neuropsychological testing), would the athlete be allowed to return to play at your institution?	3	48 (6.3)	3	158 (1.9)
(2) If your clinical examination revealed abnormalities, but the player appeared normal on standardized methods of concussion assessment (eg, SAC, BESS, neuropsychological testing), would you feel comfortable returning the athlete to play?	1	48 (2.1)	3	158 (1.9)
(3) If your clinical examination revealed no abnormalities and no concussion signs or symptoms, but the player stated, "I'm fine, I just got my bell rung," would the athlete be allowed to return to play at your institution?	28	48 (58.3)	62	157 (39.5)
(4) If your clinical examination revealed no abnormalities and no concussion signs or symptoms, but the player stated, "I'm fine, I just had my bell rung," would you feel comfortable returning the athlete to play?	15	48 (31.3)	54	157 (34.4)
(5) If a player reported postconcussion symptoms but appeared normal on standardized methods of concussion (eg, SAC, BESS, neuropsychological testing), would the athlete be allowed to return to play at your institution?	2	48 (4.2)	6	155 (3.9)
(6) If a player reported postconcussion symptoms but appeared normal on standardized methods of concussion (eg, SAC, BESS, neuropsychological testing), would you feel comfortable returning the athlete to play?	2	48 (4.2)	1	155 (0.6)
(7) If a player appeared normal on your routine clinical examination and reported no symptoms after concussion but appeared abnormal on standardized methods of concussion assessment (eg, SAC, BESS, neuropsychological testing), would the athlete be allowed to return to play at your institution?	3	48 (6.3)	17	155 (11.0)
(8) If a player appeared normal on your routine clinical examination and reported no symptoms after concussion but appeared abnormal on standardized methods of concussion assessment (eg, SAC, BESS, neuropsychological testing), would you feel comfortable returning the athlete to play?	3	48 (6.3)	14	154 (9.1)
(9) If a player were diagnosed with a concussion but all symptoms subside within 15 minutes, would the athlete be allowed to immediately return to play at your institution?	2	48 (4.2)	10	155 (6.5)
(10) If a player were diagnosed with a concussion but all symptoms subside within 15 minutes, would you feel comfortable immediately returning the athlete to play?	0	48 (0.0)	8	155 (5.2)

Abbreviations: BESS, Balance Error Scoring System; SAC, Standardized Assessment of Concussion.

[a] Adapted.[15]

allowed items were previously noted among American athletic trainers.[15] Athletic therapists may not thoroughly consider the importance of athletes reporting "having their bell rung" (Table 4, items 3 and 4) versus specific signs and symptoms, despite previous consensus statements explicitly indicating athletes should be removed from play in these circumstances.[24] Also, the additional stakeholders identified as being involved in RTP decision making or the specific RTP guidelines may negatively influence what would be allowed at an institution versus what the athletic therapist feels comfortable with. Clinicians should aim to implement medical models autonomous from athletic department or club administration stakeholders to ensure unbiased diagnoses,[29] and ARTI and CATA should consider monitoring and augmenting concussion education to improve concussion practices.[30]

Concussion Characteristics

Irish athletic therapists reported a relatively low rate of observed concussions (2.5 concussions per athletic therapist annually) relative to Canadian athletic therapists (12.2 concussions) and American athletic trainers (16.0 concussions).[8] The most frequent concussions noted annually for Irish (Gaelic football, rugby)[31–33] and Canadian (American football, rugby; Table 2)[34–36] sports in the present study were comparable with the sport concussion proportions in established epidemiologic studies. Irish athletic therapists described relatively high proportions of loss of consciousness (45.6%) and amnesia (58.8%), whereas Canadian athletic therapists recounted comparable proportions relative to the 2% to 6% and 10% to 12%, respectively, that have been reported (Table 2).[37,38] The observed proportions of concussions with symptom recovery and RTP taking >10 days were greater for Irish athletic therapists (68.4% and 98.7%, respectively) than for the Canadian cohort (26.9% and 44.6%, respectively) and US athletic trainers (28% and 59%, respectively).[37,38] These discrepancies may be related to sport-specific guidelines, such as the Irish Rugby Football Union's concussion RTP protocol requiring removal from

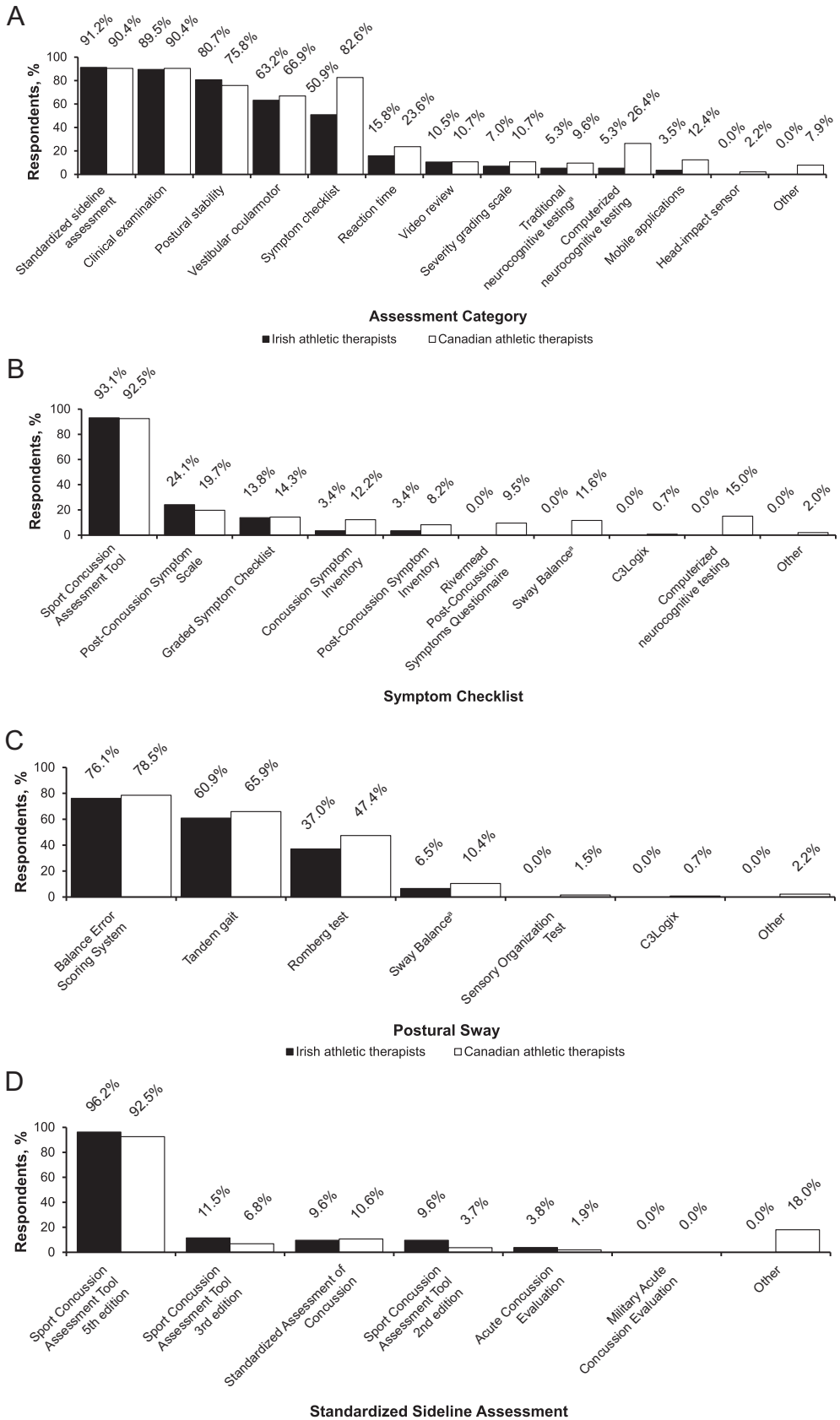

Figure 1. Concussion assessment and return to play as reported by Irish and Canadian athletic therapists. A, Proportion of concussion assessment tools. [a] Paper and pencil. B, Proportion of symptom checklists used for concussion assessment. [a] Sway Medical. C, Proportion of postural-stability assessments used for concussion assessment. [a] Sway Medical. D, Proportion of standardized sideline assessments used for concussion assessment. E, Return-to-play assessments used by Irish and Canadian athletic therapists. Participants selected all methods used. [a] Paper and pencil.

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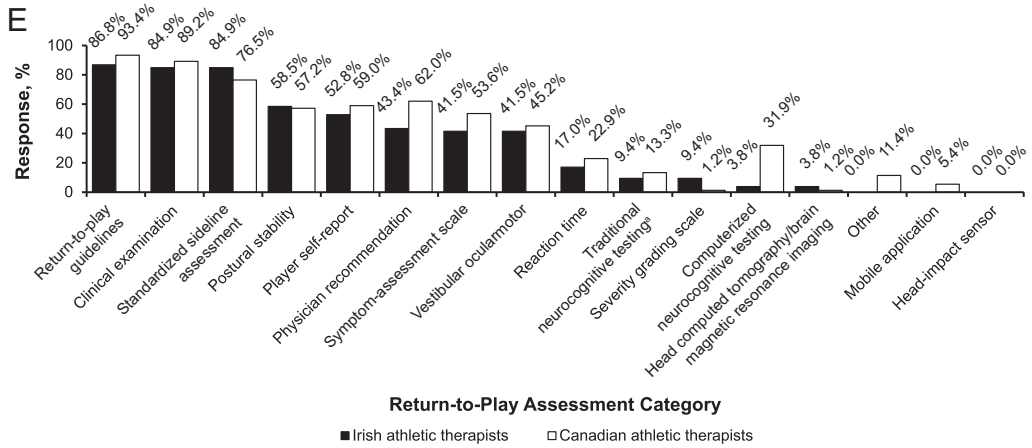

Figure 1. Continued from previous page.

sport for a 21-day minimum.[21] Other variations may reflect the inherently different sports, cultures, and policies across countries or the possibility that Irish athletic therapists may not have diagnosed all experienced concussions among their patients, as evidenced by the self-reported low annual concussion rates and high prevalences of loss of consciousness and amnesia (Table 2). Regardless, these findings should not be interpreted as true epidemiologic outcomes, and future researchers should comprehensively examine concussion epidemiology in Irish and Canadian sports.

Concussion Assessment and Management

Our study provides early insights into the concussion assessment and management benefits supplied by Irish and Canadian athletic therapists and highlights areas for improvement. The current use of assessments among Irish and Canadian athletic therapists as well as those described by American athletic trainers are shown in Figure 2.[8] Irish and Canadian athletic therapists conveyed high levels of use of clinical examinations, standardized sideline assessments, and postural stability measures for concussion diagnosis, and these levels were comparable with those of American athletic trainers (Figure 2).[8] A low percentage of Irish athletic therapists used symptom checklists, and few Irish or Canadian athletic therapists used any neurocognitive testing method. Low frequencies of 2- and 3-domain assessment battery use were noted among Irish athletic therapists, and low 3-domain use was seen among Canadian athletic therapists. Use of 2- and 3-domain assessments was even less common for RTP decision making among both cohorts. Previous investigators[15] of American athletic trainers demonstrated that 52.7% used 3-domain assessments in 2018 (Figure 2). Contrary to our hypotheses, higher levels of education and clinical experience generally were not associated with multidimensional domain assessment practices, except that Canadian athletic therapists with master's degrees had greater odds of using 2-domain but not 3-domain assessments. Our hypotheses were based on surveys of American athletic trainers in which those with fewer years of clinical experience and higher levels of education displayed greater odds for optimal clinical practices.[8,15] Why these factors affected American athletic trainers more than Irish or Canadian athletic therapists is unknown. Our findings did not allow us to determine why athletic therapists and athletic trainers implemented these practice patterns. However, this collective body of work surrounding concussion practices highlights the observation that clinical practice does not meet international consensus guidelines[1] and provides clinicians and academic stakeholders in all 3 countries with information that can enhance program and education development.

Since 1997,[39] global consensus[1,24–27] has called for symptom, balance, and neurocognitive assessments at minimum when diagnosing sport-related concussion. Symptom checklists and balance assessments are often cost-free evaluations for clinicians. Neurocognitive testing exists across many platforms (eg, paper and pencil, computerized) at various price points with equitable psychometric properties, which may facilitate accessibility for clinicians. Yet funding in Canada and Ireland for computerized neurocognitive testing may be a large barrier to implementation, especially in nonprofessional sport settings, and may partially explain suboptimal use of computerized neurocognitive testing. Athletic therapists should aim to implement a 3-domain assessment to ensure accurate concussion diagnosis and may need to request additional funding from stakeholders to allow computerized neurocognitive testing to be more readily implemented.

Irish and Canadian athletic therapists most frequently used specific RTP guidelines, a clinical examination, and standardized sideline assessments to determine RTP eligibility (Figure 1E). The RTP eligibility methods recorded were similar to those of American athletic trainers, who also most often used RTP guidelines (91%) and a clinical examination (88%). The second and third most used methods to determine RTP eligibility differed in that American athletic trainers relied on their directing physician's recommendation (68%) and computerized neurocognitive testing (61%),[8] whereas computerized neurocognitive testing was rarely administered by Irish and Canadian athletic therapists. The RTP practices are generally promising among Irish and Canadian athletic therapists, but it is valuable for clinicians to reexamine patients using the 3-domain assessment, at minimum, to verify that function has returned to preinjury or normative levels after concussion. Current international consensus guidelines[1] indicated that computerized neurocognitive testing was not a requirement for concussion diagnosis but

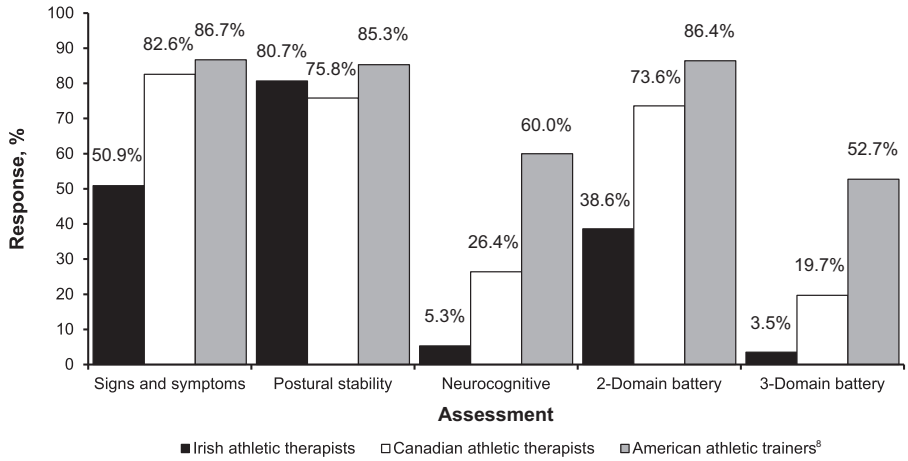

Figure 2. Concussion assessment use among athletic therapists and athletic trainers. Proportion bar plots for signs and symptoms, postural stability, neurocognitive assessment, 2-domain minimum assessment (ie, ≥2 of symptom checklist, balance assessment, or neurocognitive assessment), and 3-domain assessment (ie, symptom checklist, balance assessment, neurocognitive assessment) among Irish athletic therapists, Canadian athletic therapists, and American athletic trainers.[8]

provides additional information beneficial for assessment and RTP decision making. Importantly, a lack of objective measures can lead to biased, subjective RTP decisions and may introduce postconcussion complications.[2,3] Clinicians should aim to fully implement international consensus RTP guidelines[1,24–27] in their concussion protocols to promote patient safety. Future authors should monitor Irish and Canadian athletic therapists' concussion management strategies to monitor whether clinical practice is keeping up with evidence-based guidelines.

Limitations

This study was completed during the COVID-19 pandemic. To account for nonpandemic-related practices, we explicitly instructed participants to respond as they would have before the pandemic and during normal work responsibilities. The survey study design inherently had the potential for response, recall, or social desirability bias, or all of these. However, participants were instructed to answer honestly and accurately throughout the survey and were allowed to leave items blank or skip items; furthermore, the research team's contact information was supplied for any questions. Our survey also had various response rates between cohorts (49.7% for Irish athletic therapists, 10.1% for Canadian athletic therapists), although both response rates were in line with those of similar surveys.[8,40] Lastly, whether the surveyed Irish and Canadian athletic therapists were representative of their respective ARTI and CATA organizations is unknown. At the time of the survey, demographics were not collected by or available from the organizations, and thus, we could not compare demographics between respondents and the organizations.

CONCLUSIONS

Irish and Canadian athletic therapists possessed similar concussion knowledge to that of American athletic trainers as evidenced by their recognition of signs and symptoms and appropriate responses to patient–clinician scenarios. Still, improvements in concussion assessment and management practices are warranted to meet international consensus guidelines. Specifically, Irish and Canadian athletic therapists frequently used individual assessments such as symptom checklists or balance assessments, but these techniques were rarely applied in combination with other methods. Our results reflect frontline sport health care providers in 2 countries, and further work is needed to understand the assessment and management strategies of providers in other settings around the globe (eg, sport rehabilitators in England). Although greater funding allocations may be required, clinicians in all sport settings globally should aim to implement 3-domain minimum assessments consisting of at least symptoms, balance, and neurocognitive assessments to ensure that optimal concussion health care is provided.

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Data Availability Statement

Deidentified survey data reported are available upon reasonable request. Please contact the corresponding author for inquiries.

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