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Steering through Concussion Healthcare: Driving Recommendations and Management among Irish and Canadian Athletic Therapists

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Ethical Approval

This study was deemed exempt by the Institutional Review Board of the University of [redacted].

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Abstract

Context: Driving requires continuous sensorimotor and cognitive coordination for extended time periods, and are commonly impaired domains post-concussion. The post-concussion driving management practices and opinions of healthcare providers such as athletic trainers/therapists (ATs) are essential for effective patient recommendations, but have yet to be examined outside of the United States.

Objective: To examine post-concussion driving management practices and opinion among Irish and Canadian ATs, and to explore whether concussion assessments, highest earned degree, practice setting, or years of experience associates with post-concussion driving management practices.

Design: Cross-Sectional Study.

Setting: Online survey.

Patients or Other Participants: Fifty-three Irish and 166 Canadian athletic therapists.

Main Outcome Measures: A previously validated survey capturing demographics, self-reported management practices, and opinions for refraining (i.e., stop) and restricting (i.e., limiting) driving.

Results: The majority (50.9%) of Irish and Canadian ATs (69.9%) endorsed they "always" or "sometimes" recommended *refraining* from driving, respectively. Both cohorts commonly used verbal instructions (Irish ATs:86.8%; Canadian ATs:90.4%). Irish ATs (58.5%) favoured sideline assessments and Canadian ATs (56.6%) favoured clinical examinations to determine driving readiness. Despite agreeing or strongly agreeing that patients with a concussion pose a danger on the road (Irish ATs: 72%; Canadian ATs: 46.6%), approximately 10% of Irish and

Canadian ATs reported "never" recommending driving restrictions. Weak correlations were observed between years of experience and the number of restrictions recommended for Irish and Canadian ATs (ρ range: -0.15, 0.05).

Conclusions: We observed Irish and Canadian ATs overall have similar practices and opinions on post-concussion driving management. The lack of uniform recommendations and written instructions regarding safe return-to-driving management practices after concussion resulted in reliance on verbal advice. Our findings emphasise the need for clear and consistent guidelines related to driving after concussion.

Keywords: motor vehicle, recovery, return to activity, athletic training, protocol

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Key points:

- The lack of uniform recommendations and written instructions regarding safe return-to-driving management practices after concussion resulted in surveyed ATs reliance on verbal advice, emphasising the need for clear and consistent guidelines.
- ATs must consider the social and psychological impacts of driving restrictions on patients when delivering return-to-driving advice after concussion.
- Development of standardised protocols based on objective assessments and patient-centred care are crucial and it is incumbent that ATs globally are made aware of these developments to ensure safe return-to-driving management after concussion.

Concussion is a temporary neurological condition caused by a sudden impact to the head or body, leading to physical, neuropsychiatric, and somatic symptoms.[1] Driving is a complex activity requiring simultaneous motor, visual, and cognitive coordination including focus, attention, visual perception, and memory.[2] Driving post-concussion raises safety concerns, as individuals in the acute phase have been shown to exhibit riskier driving behaviours linked to increased motor vehicle crash potential.[3,4] Simulator-based research by Schmidt and colleagues[5] found that concussed individuals had reduced control when navigating curves and were more likely to drift toward or cross the centreline, patterns associated with higher motor vehicle crash risk, even after concussion symptoms had resolved. Additionally, recent studies indicate that individuals with concussions, even in the chronic phase, are more prone to driving infractions that could endanger others.[3,4] Recently asymptomatic individuals post-concussion were 0.29s slower when responding to simulated traffic hazards compared to healthy matched controls.[6] At 60 km/h, these effects add 4.8m to braking distance,[7] exemplifying a significant crash risk for drivers post-concussion. Reaction time impairments such as these, have been found to be present up to 2 months post-concussion, suggesting that driving restrictions (i.e., limits set on driving such as distance travelled or avoiding highway or interstate driving) may need to continue beyond the acute or symptomatic phases.[7] Conversely, a longitudinal study of post-concussion driving reaction-time found no differences between acutely concussed and healthy individuals.[8] However, individuals recently asymptomatic following concussion were found to display significantly worse lateral vehicle control as compared to individuals without concussion.[9,10] Together, these findings suggest that drivers with concussion may pose a risk to themselves and others.[11]

Despite these concerning findings, just 48% of individuals in Australia and 44% of collegiate athletes in the United States (US) reported an intention to adjust their driving activity during

concussion recovery.[11,12] However, surveyed patients experiencing a concussion indicated they would be significantly more likely to *refrain* (i.e., complete stoppage) from driving if they were advised to do so by a healthcare professional.[11] Current concussion consensus statements provide clear protocols addressing return-to-sport and return-to-learn following concussion,[13,14] but lack direct return-to-driving (RTD) guidelines with limited driving risk acknowledgement. Standardised RTD guidelines and recommendations would assist healthcare providers when educating their patients after concussion,[15] however there is currently insufficient evidence to inform standardised duration or content of RTD recommendations. Among US physicians, 49% indicated they would 'almost always' advise concussed individuals to reduce their driving, and 83% believed concussed patients had an increased risk of a motor vehicle crash.[2] Further, 30.4% of these same physicians indicated they did not have clear criteria for determining RTD readiness.[2] Healthcare providers are central to educating and providing treatment regimens for concussed patients. However, they are provided limited evidence-based guidance regarding the risks of driving after concussion, potentially due to a limited body of research specific to RTD practices or a lack of consensus regarding standardised protocols.

Athletic therapists' (AT) represent key stakeholders in concussion care due to their integrated healthcare role from the sideline to the clinic and play an influential role in RTD guideline implementation. While the opinion and practices of US ATs regarding post-concussion driving management have been investigated,[10] researchers have yet to examine the opinions and practices of ATs outside of the US. Irish and Canadian ATs perform roles comparable to those of their US counterparts, as reflected in international agreements between the three national organisations for licensure examination reciprocity.[16-18] While similar, there are key differences between US ATs and their Irish and Canadian counterparts, including differing

levels of exposure to concussion, sports medicine resources, and driving requirements, potentially leading to cross-cultural differences in awareness, and management.[19] This study included Irish and Canadian ATs to explore and compare post-concussion driving management practices in two countries where ATs share similar clinical roles but function within distinct regulatory and healthcare contexts. Despite differences in training and infrastructure, both groups are educated in evidence-based concussion care and serve as frontline providers. Thus, we aimed to examine post-concussion driving management practices and opinions among Irish and Canadian ATs, and to explore whether concussion assessments, highest earned degree, practice setting, or number of years of experience (YOE) are related to post-concussion driving management practices. Given the perceived lack of standardised guidelines, as well as varying levels of exposure and cultural differences, we hypothesised that we would observe inconsistent post-concussion driving management practices and opinions (i.e., notable variability in survey responses) and more driving recommendations and restrictions for ATs with higher education and YOE than those with lower.

Materials and Methods

Participants

Participants were included if they were certified members of the Canadian Athletic Therapists Association (n=2090 at time of survey; H. DeFazio, CATA, written communication, April 2021) or Athletic Rehabilitation Therapy Ireland (n=183 at time of survey; N. Taaffe, ARTI, written communication, April 2021). Membership in these organisations is required by Canada and Ireland to obtain AT licensure. All respondents provided informed consent before survey initiation, and this study was deemed exempt by the {redacted for blinded review} Institutional Review Board. Notable proportions of Irish (49.7%; n=91/183) and Canadian

(10.1%; n=211/2,090) ATs initiated the overall larger survey and met the inclusion criterion. Among those who initiated the survey, 48 (52.7%) Irish and 159 (75.0%) Canadian ATs completed >90% of their prompted survey items, with 53 Irish and 166 Canadian ATs completing the post-concussion driving management survey section.

Instrumentation

We used a previously developed post-concussion driving management survey for anonymous AT evaluation that was distributed online through Qualtrics (Qualtrics Lab, Inc., Provo, UT).[9] The questions examined in this study were embedded in a larger survey that investigated ATs overall concussion assessment and management healthcare practices.[20] After providing their demographic information (highest earned degree, total YOE, and primary work setting), ATs responded to survey items examining post-concussion care and decision-making related to RTD based on item display logic.

Post-concussion driving management practice

ATs were asked whether they instruct patients to refrain from (i.e., stop), or to restrict (i.e., limit) driving a motor vehicle after a concussion and were given the options of 'always', 'sometimes', or 'never' as responses. Those who responded 'always' or 'sometimes' were then asked questions related to the content and delivery of advice they provided to their patients, including how long they would typically advise a patient to refrain from or restrict their driving, the methods they typically utilise to provide instructions or to decide whether a patient can resume driving a motor vehicle, what restrictions they usually provide when a patient returns to driving a motor vehicle, and the proportion of patients with concussion that they advised not to drive. Answers were provided using a drop-down menu of predefined options. Those who reported 'never' advising any driving restrictions following a concussion

were asked for their reasoning regarding their answer using a drop-down menu of response options.

Post-concussion driving opinion

Nine statements that pertained to driving after a concussion were also given to each AT, regardless of responses on the previous section, and each respondent was asked to rate how strongly they agreed on a 7-point Likert scale (1=strongly disagree; 4=neither agree or disagree; 7=strongly agree). These included statements such as; 'Patients with suspected concussion should not drive a motor vehicle until cleared to do so by a healthcare professional', 'Driving is socially important', '*Restricting* (i.e., limiting) driving may discourage individuals from reporting their concussion', '*Refraining* (i.e., stopping) from driving may harm the patients socially, which might affect their recovery', and 'I am confident that patients would follow my recommendations to *refrain* from driving following a concussion'. See Table 4 for all statements.

Procedures

Content validity of the entire online survey was assessed to ensure appropriate item clarity for Irish and Canadian AT cohorts independently. We then piloted the survey among Irish (n=5) and Canadian (n=5) ATs to ensure survey functionality, item clarity, and collect qualitative feedback. The final survey was then revised according to this feedback prior to distribution.

The survey was sent via e-mail to ARTI and CATA members in February 2021 from these respective organisations via a cover letter, informed consent statement, and a weblink to complete the online survey from a computer or mobile device. Participation invitations were also included in each organisation's reoccurring newsletter. Follow-up survey reminders were sent at three- and six-weeks after the initial invitation. Multiple survey responses from an AT

were disabled through Qualtrics, and all survey items could be skipped based on the AT's comfort responding to each individual item. The survey was active for a total of eight-weeks, and all partial survey completions were recorded.

Statistical Analysis

Responses were exported from Qualtrics and imported for data processing and analysis via The R Project for Statistical Programming (version 3.4.3; The R Foundation), with statistical significance set to α=0.05 *a priori*. To preserve contextual nuances and identify regional differences in practice, professional scope, and policy, each cohort was analysed separately. For analysis purposes, Likert-scale responses were also collapsed, with 'strongly agree' and 'agree', and 'strongly disagree' and 'disagree' combined into a single category each to facilitate interpretation. AT opinions on driving following a concussion and post-concussion driving management practices were analysed using descriptive statistics (proportions, frequencies, means, SDs, medians) where appropriate. As individual item responses were not required, sample size varied for each survey item. The relationship of the ATs highest earned degree and their setting with the number of driving restrictions advised was evaluated using separate Fisher's Exact tests. We were unable to include degrees beyond a master's (e.g., doctor of philosophy) or some career settings (e.g., military or industry) due to sample size limitations. We calculated Spearman's rho (ρ) correlations to evaluate the relationship between YOE and the proportion of patients advised to *refrain* from driving. The odds of using specific concussion assessments[9,20-22] to determine when a patient could resume driving a motor vehicle after a concussion (among ATs that selected "always" or "sometimes" since assessment questions were not viewed by those selecting "never") were calculated using separate univariate binary logistic regression models with odds ratio (OR) effect estimates

and corresponding 95% confidence intervals (95% CI), with 95% CIs not containing 1.00 considered statistically significant.

Results

Post-Concussion Driving Management Practices

Irish ATs

A total of 53 Irish ATs with an average of 8.1±8.2 (range: 1-30 years) YOE completed the survey (Table 1). Half (50.9%) of Irish ATs reported 'always' recommending their concussed patients *refrain* from driving with 45.3% 'always' recommending patients *restrict* driving (Table 2). Irish ATs estimated they would advise 75.3±29.6% of their patients to *refrain* and 79.7±28.0% to *restrict* driving post-concussion (Table 2). The most common recommendation was to *refrain* from (32.1%) or *restrict* (34.0%) driving until cleared by another healthcare provider or symptoms resolved (Table 2). Most Irish ATs (58.5%) used a standardised sideline assessment (e.g., Sports Concussion Assessment Tool, 5th Edition) to determine driving readiness, with 86.8% providing verbal instructions. However, 47.2% do not recommend restrictions for patients returning to driving (Table 2). Among ATs who 'never' recommend driving *restrictions* (11.3%), and from 8 predefined response options as well as an open-ended 'other' category, the most common reasons within this subgroup were; that they had "never really given driving restrictions much thought" (12.0%) or that they "don't have enough information to guide decisions about when to restrict driving" (8.0%; Table 3).

Canadian ATs

Canadian ATs (*n*=166) with 12.6±8.3 (range: 1-43 years) YOE completed the survey (Table 1). The majority (69.9%) of Canadian ATs 'sometimes' recommend *refraining from* driving, typically until symptom resolution (37.3%; Table 2). Most (60.4%) would recommend *restricting* driving 'sometimes', with 39.2% advising *restriction* until symptom resolution.

Canadian ATs estimated advising 56.4±35.6% of their concussed patients to *refrain* from driving and 57.3±35.4% to *restrict* driving (Table 2). To assess readiness to drive, 56.6% use a clinical examination (defined in Table 2), while 90.4% give verbal instructions. Canadian ATs also recommend minimising distractions when patients resume driving (45.8%; Table 2). Of those who 'never' recommend *restricting* driving (9.8%), and from 8 predefined response options as well as an open-ended 'other' category, the most common answers cited within this subgroup were; "never really giving driving restrictions much thought" (15.7%) and "driving restrictions have not been emphasised in most publications and/or directives (e.g. position/consensus statements)" (11.8%; Table 3).

Post-Concussion Driving Management Opinions

Irish ATs

Table 4 provides the driving opinion response frequencies and proportions, with the most common referenced here. Irish ATs strongly agreed/agreed (72.0%) that patients impaired by a concussion are a danger on the road. They also strongly agreed/agreed (60.0%) that patients with a suspected concussion should not drive a motor vehicle until cleared to do so by a healthcare professional. Irish ATs strongly agreed/agreed that *refraining* from driving may discourage individuals from reporting their concussion (48.0%) and that driving is socially important (46.9%). Many respondents strongly agreed/agreed (36.7%) that *restricting* driving may discourage individuals from reporting their concussion.

Canadian ATs

Canadian ATs strongly agreed/agreed (44.6%) that patients with suspected concussion should not drive a motor vehicle until cleared to do so by a healthcare professional and strongly agreed/agreed (46.6%) that patients impaired by a concussion are a danger on the road. Canadian ATs strongly agreed/agreed that they are confident that their patients would follow

their recommendations to *restrict* (36.6%) and to *refrain (*31.7%) from driving following a concussion.

Factors Related to Driving Recommendations

Irish ATs who 'always' recommend driving restrictions had significantly lower odds of using a reaction time assessment (OR:0.14; 95% CI:0.01,0.95) to determine whether a patient could resume driving following a concussion, relative to those who 'sometimes' recommend driving restrictions. There were no significant differential odds for using a clinical examination, symptom assessment scale, standardised sideline assessment, neurocognitive testing, balance assessment, or oculomotor screening among Irish or Canadian ATs (Table 5).

No significant associations were observed between highest earned degree and the percentage of patients instructed to *refrain* and *restrict* driving or the number of driving restrictions recommended to patients. No significant association was observed between YOE and the percentage of patients instructed to *refrain* or *restrict* driving. However, a significant association was observed between the number of YOE and number of driving restrictions provided for both Irish and Canadian ATs (Table 6). Specifically, Irish ATs who recommended two driving restrictions had 8.8 more YOE being a certified AT, and Canadian ATs who gave one driving restriction had 5.5 less years of being a certified AT, than those who did not provide driving restrictions (Table 6). Weak correlations were observed between the proportion of patients instructed to *refrain* (Irish: ρ=0.05; Canadian: ρ=-0.02) and *restrict* (Irish: ρ=0.03; Canadian: ρ=-0.15) driving with total years certified.

Discussion

While ATs were overall aware of the potential impact of concussion on driving safety, with a notable proportion of Irish (96.2%) and Canadian ATs (97.0%) recommending, at least sometimes, that concussed patients *refrain* from driving, the small number who had never

considered this issue highlights variability in clinical awareness and the need for consistent guidelines. While it is clear that considerable proportions of ATs recommend driving restrictions to certain concussed patients, little is known as to how these patients are selected or why these recommendations are not standardised across all patients. While Canadian ATs most frequently advised patients to *refrain* from driving until symptom resolution, Irish ATs equally advised patients to *refrain* from driving until symptoms resolve or until cleared by another healthcare provider. Although ATs are trained healthcare providers involved in concussion management, some may not view driving clearance as within their formal clinical scope or legal responsibility. In the absence of clear RTD guidelines, this ambiguity may contribute to their reluctance to make independent driving-related decisions, despite their frontline role in concussion care. According to previous research, driving impairments may persist after concussion symptoms have resolved;[23] however, 20.5% of athletes who *refrain* from driving following a concussion usually resume driving within 24-48 hours post-concussion.[11] Hyper-conservative management approaches would see *refraining* until symptoms have subsided as reasonable, however, there are potential negative quality of life effects with strict *refraining*.[24]

Determining the appropriate duration for refraining from driving post-concussion is challenging, not only due to recovery variability but also because of the practical impact on patients' daily activities. Concerningly, a paucity of ATs strongly agree/agree (Irish ATs: 0.0%; Canadian ATs: 4.9%) that *restricting* driving could have harmful effects on patients. However, while many ATs in this study from both cohorts expressed confidence that patients would follow driving recommendations that were given, a significant number of patients may not adhere to post-concussion driving recommendations, a trend observed in individuals with other neurological conditions.[11] Previous research found that 22% of athletes drove a vehicle

following a concussion due to lack of alternative transportation.[11] This highlights the need for healthcare providers to emphasise other transport options, such as public transit or carpooling.[9] Balancing driving recommendations with clinical judgement and patients' need for independence is crucial.[9] More evidence is needed to balance driving restrictions with potential social, psychological, and vocational consequences, underscoring the importance of future research to identify objective methods for detecting individuals with heightened driving risk for individualised, impairment-based concussion management.[13,14]

While consensus and position statements provide structured return-to-sport and return-to-school protocols,[13,14] they have yet to provide a RTD protocol, despite its relevance to patient safety and daily functioning. This omission may reflect the limited research specific to RTD, the jurisdictional complexity of driving regulations, or the lack of clearly defined milestones or standardised assessment tools. To guide ATs and other healthcare providers in providing adequate post-concussion driving management, evidence-based recommendations, or in the absence of evidence; best practice guidelines are necessary to achieve medical consensus. Similar to related research performed with ATs in the US,[9] we found 30.8% and 33.3% of Irish and Canadian ATs respectively "never" recommend their patients suffering with concussion *refrain* from driving.[9] US, Irish, and Canadian ATs primarily attributed this to "never really giving driving restrictions much consideration". Given the potential safety risks associated with impaired driving post-concussion, clinician education on driving management should be prioritised and delivered early, potentially even before a robust evidence base is established. Early awareness can prompt providers to consider driving safety, identify practical concerns, and help shape research priorities, supporting a precautionary approach that safeguards patients while evidence continues to develop.

ATs most commonly provided verbal advice regarding post-concussion driving recommendations. As cognitive impairments and low health literacy are common problems in individuals with acute concussion, delivery of verbal driving recommendations is likely insufficient for patients to understand and recall healthcare recommendations.[25,26] Thus, incorporating evidence-based written instructions provided to both the patient and a caregiver (if applicable) may be beneficial. This can enhance patient understanding and support safer decision-making. Furthermore, documenting patients' acknowledgment of these risks may help clinicians mitigate liability concerns, ensuring that patients are aware of and accept the potential dangers involved.

A positive relationship between YOE and the number of driving restrictions given was observed in Irish ATs such that those who provided two driving restrictions had 8.8 more YOE than those who did not provide any. Less experienced or novice ATs may feel overwhelmed when managing their first concussion cases and may lack the confidence or clinical exposure needed to implement a fully multifactorial approach to treatment, such as including driving restrictions. In contrast, more experienced ATs may have developed this capacity over time through cumulative clinical exposure, continuing education, and familiarity with evolving concussion guidelines. In contrast, Canadian ATs who issued one driving restriction had 5.5 fewer years of AT experience when compared to those who issued zero driving restrictions. Perhaps in this cohort, ATs with fewer YOE feel the need to act more conservatively than their more experienced counterparts and thoroughly cover all aspects of concussion care. This could also represent sociocultural differences and possibly disparate educational experiences provided to these groups, particularly as the AT profession is relatively newer in Ireland compared to Canada.

In assessing a patient's RTD readiness, most Irish ATs reported using their standardised sideline evaluations. These tools however, were not specifically designed or validated to determine driving fitness, highlighting a gap in current concussion assessment protocols that warrants further research. In contrast, Canadian ATs most often relied on clinical examinations to determine if a patient was ready to resume driving. This approach is similar to that used by US ATs, where clinical examinations are also the primary tool for assessing readiness to RTD.[9] Both cohorts also frequently used oculomotor assessments, symptom assessment scales, balance assessments, and reaction-time assessments. Interestingly, Irish ATs who "sometimes" provide driving restrictions to concussed patients were more likely to use reaction time assessments than those who "always" advise driving limitations. This suggests that those who are more selective in their recommendations may take a more comprehensive approach when deciding which patients need driving restrictions. Additionally, Irish ATs tend to rely more on objective evaluations, compared to Canadian ATs, who may use more subjective assessments, like symptom evaluations, which are more prone to variability based on patient self-reporting. Similarly, in the US, ATs who consistently recommend driving restrictions are also more likely to use standardised objective assessments rather than relying on subjective, patient-reported measures.[9]

Irish and Canadian ATs in this study strongly agreed/agreed (Irish ATs: 72%; Canadian ATs: 46.6%) that individuals compromised by a concussion constitute a hazard to the road, similar to findings among sports medicine specialists,[2] however roughly 1 in 10 still report 'never' recommending driving *restrictions* despite these views. The lack of standardised recommendations and directives in position statements may be the reason for these seemingly disparate answers.[13,14] Although the relationship between motor vehicle crash risk and post-concussion driving impairment has not been thoroughly investigated, the majority

of student-athletes previously reported that they would feel "very unsafe" driving a car immediately after sustaining a concussion.[11] A third however, disclosed that they only *refrained* from driving following previous concussions "because a healthcare provider told them to", while 56% did not *refrain* from driving at any point.[11] This highlights the importance of delivering direct and comprehensive driving recommendations to concussed patients.

Limitations

This study benefits from a large, diverse sample of certified ATs from Canada and Ireland, ensuring broad applicability to these populations. The use of a previously validated survey, piloted with both Irish and Canadian ATs, ensured clarity and functionality, while follow-up survey invitations helped maximise response rates. However, survey responses are subjective, and therefore may be prone to recollection, ascertainment, and social desirability biases, with not all participants initiating the survey completing it. To potentially reduce response bias, the driving-related questions were embedded within a broader survey[19] on concussion management practices. This approach may have limited participants from overemphasising or modifying their responses specifically in relation to driving behaviours but we cannot be certain. Although our response rate was relatively low, it was comparable to other survey studies conducted among ATs[27-29] and the proportion of the total certified AT population represented in our sample was relatively high in Ireland (29.0%) while more modest in Canada (7.9%). Generalisability of our findings to other clinicians in the respective country is not recommended. Without standardised, evidence-based guidelines for RTD decisions, the findings may not reflect the practices or challenges faced by other healthcare professionals who are involved in concussion management. Thus, ascertaining the practices of other clinicians (e.g. physicians, chartered physiotherapists, etc.) is warranted.

Conclusion

This study highlights the variability in post-concussion driving recommendations among Irish and Canadian ATs, with most always or sometimes recommending that patients *refrain* from driving. While both groups commonly use sideline evaluations or clinical examinations to assess a patient's readiness to drive, there are no standardised, evidence-based or practice-based uniform guidelines for determining when it is safe to RTD after a concussion. The lack of uniform recommendations and reliance on verbal advice instead of written instructions suggests a need for clearer, more consistent, written guidelines. Although clinical or educational experiences were not strongly associated with driving recommendations, ATs must consider the social and psychological impacts of driving restrictions on their patients. Moving forward, development of standardised protocols based on objective assessments and patient-centred care are crucial and it is incumbent ATs globally are made aware of these developments to ensure effective and safe RTD management after concussion.

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Table 1. Athletic Therapist Demographics.

Category	Irish ATs (n=53) % (n)	Canadian ATs (n=166) % (n)
Highest Degree Earned		
Bachelor's	67.9 (36)	67.5 (112)
Master's	28.3 (15)	19.3 (32)
Clinical Doctorate	0.0 (0)	0.0 (0)
Doctorate of Philosophy/Education	3.8 (2)	3.6 (6)
Medical Doctor	0.0 (0)	0.0 (0)
No response	0.0 (0)	9.6 (16)
Clinical Experience		
Works Clinically	83.0 (44)	89.8 (149)
Does Not Work Clinically	17.0 (9)	10.2 (17)
Primary Work Setting		
High School Athletics	0.0 (0)	9.1 (15)
College Athletics/Sports	3.8 (2)	20.0 (33)
Sports Medicine Clinic	5.7 (3)	31.5 (52)
General Hospital Setting	0.0 (0)	2.4 (4)
Professional Athletics/Sports	0.0 (0)	4.8 (8)
Academic Department (Education/Faculty)	13.2 (7)	4.8 (8)
Own Private Practice	45.3 (24)	9.1 (15)
Club Athletics/Sports	28.3 (15)	1.2 (2)
Corporate Health	0.0 (0)	1.2 (2)
Industrial Setting	0.0 (0)	1.8 (3)
Fitness Centre	0.0 (0)	3.6 (6)
Personal Trainer	0.0 (0)	1.8 (3)
Medical Sales	0.0 (0)	1.8 (3)
Other	3.8 (2)	6.7 (11)

%; percentage, n; number.

Table 2. Post-Concussion Driving Management Practices Among Athletic Therapists.

Question	Irish ATs (n=53) % (n)	Canadian ATs (n=166) % (n)
Do you recommend patients *refrain* (i.e., stop) from driving a vehicle?		
Always	50.9 (27)	27.1 (45)
Sometimes	45.3 (24)	69.9 (116)
Never	3.8 (2)	3.0 (5)
Do you recommend patients *restrict* (i.e., limit) driving a vehicle?		
Always	45.3 (24)	29.9 (49)
Sometimes	43.4 (23)	60.4 (99)
Never	11.3 (6)	9.8 (16)
How long do you typically recommend patients *refrain* from driving?		
Less than 24 hours	3.8 (2)	2.4 (4)
24-48 hours	28.3 (15)	16.3 (27)
2-4 days	1.9 (1)	7.8 (13)
4-6 days	0.0 (0)	1.2 (2)
Until symptom resolution	30.2 (16)	37.3 (62)
Until cleared by another healthcare professional	32.1 (17)	30.7 (51)
Beyond when cleared by another healthcare professional	0.0 (0)	0.0 (0)
How long do you typically recommend patients *restrict* driving?		
Less than 24 hours	1.9 (1)	3.0 (5)
24-48 hours	17.0 (9)	8.4 (14)
2-4 days	1.9 (1)	9.0 (15)
4-6 days	0.0 (0)	3.6 (6)
Until symptom resolution	34.0 (18)	39.2 (65)
Until cleared by another healthcare professional	34.0 (18)	24.7 (41)
Beyond when cleared by another healthcare professional	0.0 (0)	0.0 (0)
Methods used to provide instructions regarding driving after concussion (check all that apply):		
Paper handout	28.3 (15)	31.9 (53)
Verbal instructions	86.8 (46)	90.4 (150)
Email	17.0 (9)	15.7 (26)
Other (please specify)	11.3 (6)	10.8 (18)
Methods used to determine when a patient can resume driving (check all that apply):		
Clinical examination[a]	54.7 (29)	56.6 (94)

Symptom assessment scale	22.6 (12)	32.5 (54)
Standardised sideline assessment	58.5 (31)	51.2 (85)
Concussion severity scale	7.5 (4)	3.0 (5)
Neurocognitive testing	5.7 (3)	10.2 (17)
Balance assessment	24.5 (13)	25.9 (43)
Ocular motor assessment	24.5 (13)	37.3 (62)
Reaction time assessment	13.2 (7)	19.3 (32)
Head impact sensor	0.0 (0)	0.0 (0)
Mobile application concussion assessment	0.0 (0)	1.2 (2)
Other (please specify)	17.0 (9)	14.5 (24)
Recommendations given when a patient returns to driving after concussion (check all that apply):[b]		
Minimise distractions	26.4 (14)	45.8 (76)
Minimise night driving	28.3 (15)	41.0 (68)
Drive short distances	32.1 (17)	43.4 (72)
Avoid following cars closely	9.4 (5)	11.4 (19)
Avoid highways or high-speed roads	9.4 (5)	23.5 (39)
Drive with a passenger	24.5 (13)	22.3 (37)
I do not provide recommendations when they return to driving	47.2 (25)	30.7 (51)
Other (please specify)	7.5 (4)	9.0 (15)
Mean Percentage of Patients Instructed to *Refrain* from Driving	75.3% ± 29.6	56.4% ± 35.6
Mean Percentage of Patients Instructed to *Restrict* Driving	79.7% ± 28.0	57.3% ± 35.4

%; percentage, n; number. [a]defined and presented to participants as evaluating patient history, palpation of the head, face, and neck, cranial nerve assessment, and a brief motor and sensory exam of the upper and lower extremities. [b] Items reflect the driving restriction counts used in Table 6.

Table 3. Reasons Athletic Therapists Do Not Restrict Driving Following Concussion.

Reason	Irish ATs (n=25) % (n)	Canadian ATs (n=51) % (n)
Most of the patients I manage are not of driving age (<16 years old)	4.0 (1)	3.9 (2)
I don't think that a concussion influences driving ability	0.0 (0)	0.0 (0)
Driving restrictions have not been emphasised in most publications/directives	4.0 (1)	11.8 (6)
I don't have enough information to guide decisions about when to restrict driving	8.0 (2)	9.8 (5)
I worry that restricting driving will harm the patient socially, affecting recovery	0.0 (0)	0.0 (0)
I have never really given driving restrictions much thought	12.0 (3)	15.7 (8)
Patients might be upset with me if I restrict their driving	0.0 (0)	0.0 (0)
Parents/guardians might be upset if I restrict their child's driving	0.0 (0)	0.0 (0)
Other (please specify)	8.0 (2)	9.8 (5)

%; percentage, n; number.

Table 4. Athletic Therapists' Level of Agreement on Post-Concussion Driving Recommendations.

Statement	Irish ATs (n=53) % (n)	Canadian ATs (n=166) % (n)
Patients with suspected concussion should not drive until cleared by a healthcare professional.		
Strongly Disagree	8.0 (4)	1.9 (3)
Disagree	0.0 (0)	5.0 (8)
Somewhat Disagree	6.0 (3)	10.7 (17)
Neither Agree nor Disagree	4.0 (2)	15.1 (24)
Somewhat Agree	22.0 (11)	22.6 (36)
Agree	24.0 (12)	26.4 (42)
Strongly Agree	36.0 (18)	18.2 (29)
Driving is socially important.		
Strongly Disagree	4.1 (2)	3.1 (5)
Disagree	2.0 (1)	8.2 (13)
Somewhat Disagree	6.1 (3)	8.2 (13)
Neither Agree nor Disagree	16.3 (8)	20.8 (33)
Somewhat Agree	24.5 (12)	25.8 (41)
Agree	30.6 (15)	25.8 (41)
Strongly Agree	16.3 (8)	8.2 (13)
***Restricting* driving may discourage individuals from reporting their concussion.**		
Strongly Disagree	0.0 (0)	5.6 (9)
Disagree	8.2 (4)	14.9 (24)
Somewhat Disagree	4.1 (2)	9.3 (15)
Neither Agree nor Disagree	8.2 (4)	11.2 (18)
Somewhat Agree	42.9 (21)	34.8 (56)
Agree	24.5 (12)	20.5 (33)
Strongly Agree	12.2 (6)	3.7 (6)
***Refraining* from driving may discourage individuals from reporting their concussion.**		
Strongly Disagree	0.0 (0)	5.6 (9)
Disagree	6.0 (3)	16.8 (27)
Somewhat Disagree	4.0 (2)	9.3 (15)
Neither Agree nor Disagree	10.0 (5)	8.7 (14)
Somewhat Agree	32.0 (16)	32.3 (52)
Agree	36.0 (18)	23.0 (37)
Strongly Agree	12.0 (6)	4.3 (7)
***Restricting* driving may harm the patient socially, affecting their recovery.**		
Strongly Disagree	6.0 (3)	6.2 (10)
Disagree	18.0 (9)	19.9 (32)
Somewhat Disagree	24.0 (12)	23.6 (38)
Neither Agree nor Disagree	28.0 (14)	24.2 (39)
Somewhat Agree	24.0 (12)	21.1 (34)

Agree	0.0 (0)	4.3 (7)
Strongly Agree	0.0 (0)	0.6 (1)
***Refraining* from driving may harm the patient socially, affecting their recovery.**		
Strongly Disagree	6.1 (3)	6.8 (11)
Disagree	20.4 (10)	19.9 (32)
Somewhat Disagree	24.5 (12)	21.7 (35)
Neither Agree nor Disagree	20.4 (10)	20.5 (33)
Somewhat Agree	22.4 (11)	24.8 (40)
Agree	6.1 (3)	5.6 (9)
Strongly Agree	0.0 (0)	0.6 (1)
Patients impaired by a concussion are a danger on the road.		
Strongly Disagree	2.0 (1)	0.6 (1)
Disagree	0.0 (0)	1.2 (2)
Somewhat Disagree	0.0 (0)	5.0 (8)
Neither Agree nor Disagree	0.0 (0)	17.4 (28)
Somewhat Agree	26.0 (13)	29.2 (47)
Agree	36.0 (18)	29.2 (47)
Strongly Agree	36.0 (18)	17.4 (28)
I am confident patients would follow my recommendations to *restrict* driving following a concussion.		
Strongly Disagree	0.0 (0)	0.0 (0)
Disagree	14.0 (7)	5.0 (8)
Somewhat Disagree	12.0 (6)	13.0 (21)
Neither Agree nor Disagree	16.0 (8)	9.9 (16)
Somewhat Agree	34.0 (17)	35.4 (57)
Agree	22.0 (11)	30.4 (49)
Strongly Agree	2.0 (1)	6.2 (10)
I am confident patients would follow my recommendations to *refrain* from driving following a concussion.		
Strongly Disagree	4.0 (2)	0.0 (0)
Disagree	12.0 (6)	7.5 (12)
Somewhat Disagree	10.0 (5)	14.9 (24)
Neither Agree nor Disagree	24.0 (12)	12.4 (20)
Somewhat Agree	26.0 (13)	33.5 (54)
Agree	22.0 (11)	26.1 (42)
Strongly Agree	2.0 (1)	5.6 (9)

%; percentage, n; number.

Table 5. Odds of Using Concussion Assessment Tools by Driving Recommendation ("Always" versus "Sometimes")[a]

	Recommend a patient *refrain* (i.e. stop) from driving				Recommend a patient *restrict* (i.e. limit) from driving			
	Canadian ATs		Irish ATs		Canadian ATs		Irish ATs	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Clinical examination	0.66	(0.33, 1.34)	2.11	(0.66, 7.17)	1.35	(0.66, 2.75)	1.48	(0.43, 5.25)
Symptom assessment scale	0.99	(0.47, 2.05)	0.71	(0.18, 2.66)	0.84	(0.41, 1.75)	0.63	(0.16, 2.39)
Standardised sideline assessment	1.35	(0.67, 2.75)	2.23	(0.67, 7.93)	0.58	(0.28, 1.18)	2.35	(0.65, 9.30)
Neurocognitive testing	1.70	(0.49, 5.40)	-[b]	-[b]	1.08	(0.33, 4.15)	-[b]	-[b]
Balance assessment	1.17	(0.53, 2.51)	0.59	(0.15, 2.13)	1.08	(0.51, 2.40)	0.51	(0.13, 1.90)
Ocular motor assessment	0.74	(0.35, 1.51)	0.59	(0.15, 2.13)	1.09	(0.54, 2.22)	0.39	(0.09, 1.50)
Reaction time assessment	1.23	(0.51, 2.81)	0.14	(0.01, 0.95)	0.62	(0.28, 1.42)	-[b]	-[b]

[a] Concussion severity scale, head impact sensor, and mobile application concussion assessment use were not modelled due to insufficient overall response frequencies.

[b] Model not conducted due to insufficient cases within each variable level.

Abbreviations: AT=Athletic therapist; OR=odds ratio; 95% CI=95 percent confidence interval.

Table 6. Association Between Years Certified and Number of Driving Restriction Recommendations

-	Canadian ATs			Irish ATs		
# of Driving Restrictions[a]	**Mean Difference (years)**	**(95% CI)**	**p-value**	**Mean Difference (years)**	**(95% CI)**	**p-value**
0	Referent (mean=13.83)			Referent (mean=8.23)		
1	**-5.50**	**(-10.63, -0.37)**	**0.036**	-[a]	-[a]	-[a]
2	-1.38	(-5.41, 2.65)	0.500	**8.77**	**(0.31, 17.23)**	**0.043**
3	-1.24	(-5.27, 2.78)	0.543	-2.86	(-9.23, 3.51)	0.37
4+	-2.15	(-5.48, 1.18)	0.204	-3.23	(-10.37, 3.90)	0.366

[a] Number of driving restrictions are the participant sum count of items selected from the "Recommendations given when a patient returns to driving after concussion (check all that apply):" item in Table 2.
[b] No cases were present for 1 driving restriction recommendation being made, and thus the level was dropped from the model.

Abbreviations: #=number, CI=95 percent confidence interval.