

## [ Primary Care ]

# Physicians' Management Practices and Perceived Health Risks When Postconcussion Symptoms Persist

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**Background:** Concussion guidelines recommend physical and cognitive rest until all postconcussion symptoms resolve, in part because of potential health risks, including catastrophic injury related to a second impact. However, when postconcussion symptoms persist for weeks or months, these risks are poorly characterized.

**Hypothesis:** Physicians' perceived health risks and management strategies for patients with persistent postconcussion symptoms will vary.

**Study Design:** Cross-sectional study.

**Level of Evidence:** Level 3.

**Methods:** A survey of the physician members of the American College of Sports Medicine assessed the perceived health risks related to advancing activity, the indications for neuroimaging, and the referral patterns for patients with persistent postconcussion symptoms.

**Results:** A total of 572 physicians completed the survey (response rate, 27.2%). The majority of physicians recommended physical rest (97.4%) and cognitive rest (93.8%) within the first week of injury. Perceived health risks related to advancing activity in the symptomatic patient differed at 2 weeks versus 3 months after injury ( $P < 0.001$  for all comparisons). Respondents from the United States were more likely to list second impact syndrome as a potential health risk at 2 weeks compared with respondents from other countries ( $P = 0.04$ ). The majority (56%) responded that the risk of second impact syndrome remains until all symptoms resolve. When postconcussion symptoms persist beyond 1 month, 61.9% of physicians responded that neuroimaging is indicated. Approximately 60% of respondents had access to a multidisciplinary concussion clinic within 60 miles of their practice.

**Conclusion:** When postconcussion symptoms persist, the perceived health risks, management practices, and access to multidisciplinary care vary among physicians.

**Keywords:** concussion; postconcussion syndrome; mild traumatic brain injury; management; survey

It is estimated that 1.6 to 3.8 million sport-related traumatic brain injuries (TBIs) occur in the United States each year, the majority of which are concussions.<sup>11</sup> All current concussion management guidelines from the American Academy of Neurology,<sup>5</sup> American Academy of Pediatrics,<sup>8</sup> American Medical Society for Sports Medicine,<sup>9</sup> National Athletic Trainers' Association,<sup>1</sup> and 4th International Conference on Concussion in Sport<sup>15</sup> recommend physical and cognitive rest as the

cornerstone for acute management of the symptomatic patient after concussion.

Some degree of physical and cognitive rest postinjury may hasten recovery,<sup>2</sup> but the management recommendation originates from the potential health risks related to prematurely advancing physical activity.<sup>9</sup> Patients who return to sports while symptomatic from acute concussion may have a lowered concussion threshold with subsequent impact,<sup>6</sup> while poor

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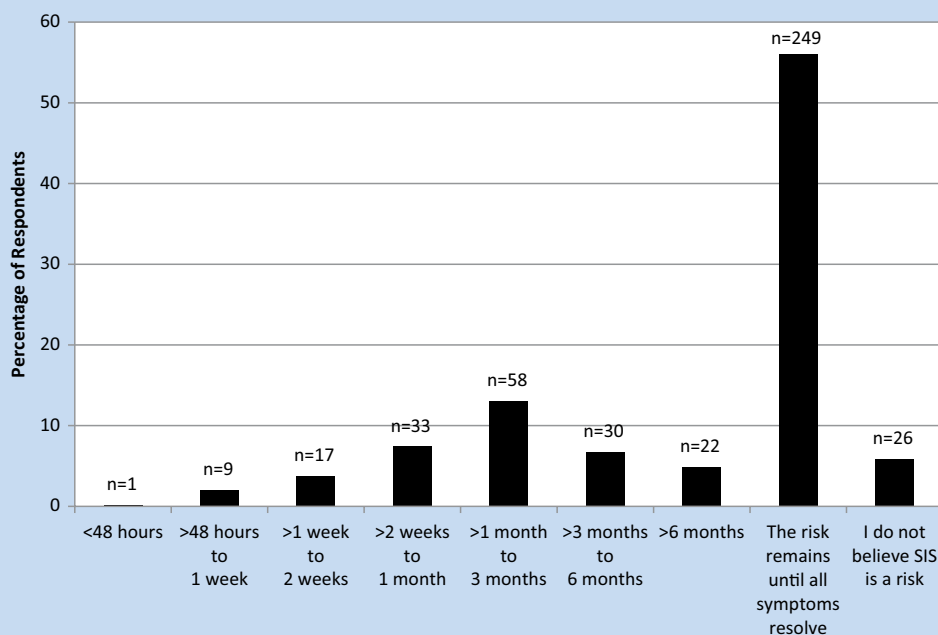


Figure 1. Visual representation of responses to the question: In the adolescent patient who continues to experience postconcussion symptoms, what is the earliest time period after injury where second impact syndrome (SIS) is no longer a risk? Excludes respondents who were not familiar with SIS ( $n = 16$ ) and those who did not have an opinion ( $n = 111$ ).

balance and slowed reaction times may increase collision risk, further increasing risk of injury.<sup>7,9</sup> Among high school and collegiate football players, 79% to 92% of same-season repeat concussions occur within 10 days of the initial concussion.<sup>6,13</sup> Advancing activity in the symptomatic patient may exacerbate concussion symptoms and delay overall recovery. The most concerning health risk related to the premature advance of activity in the symptomatic concussion patient is catastrophic injury, specifically second impact syndrome (SIS).<sup>16</sup> While the patient is still symptomatic from an acute concussion, the brain is prone to autoregulatory dysfunction.<sup>18</sup> With a second impact, malignant cerebral edema and herniation can develop, resulting in a nearly 100% mortality rate.<sup>16,21</sup>

While consensus exists about general concussion management acutely after injury, very little is known about the potential health risks when postconcussion symptoms persist beyond the typical recovery time of 7 to 10 days. Rather than continuing physical and cognitive rest, the gradual resumption of preinjury activities may be beneficial.<sup>19,20</sup> Since the potential health risks are not well characterized after this early postconcussion period, management practices may vary. The aim of the current study was to determine physicians' perceived health risks and management strategies for the patient with postconcussion symptoms that persist beyond the typical 7- to 10-day recovery period.

## METHODS

This study was approved by the institutional review board at Nationwide Children's Hospital. We conducted a

cross-sectional survey of the American College of Sports Medicine (ACSM) physician members. From September to October 2013, email invitations containing a unique survey link were sent, with up to 2 subsequent email reminders sent at 2- to 4-week intervals.

The survey (see Appendix, available at <http://sph.sagepub.com/content/by/supplemental-data>) queried respondents about their management practices and the perceived health risks when patients have persistent postconcussion symptoms. Specific survey questions addressed physician demographics and medical practice characteristics, the roles for physical and cognitive rest after acute concussion, the perceived health risks associated with advancing activity in the patient with persistent symptoms at 2 weeks and at 3 months, the perceived time frame for SIS risk, the indications for neuroimaging when symptoms persist for more than 1 month, referral patterns when symptoms persist, and access to multidisciplinary concussion clinics. The survey was face-validated by 10 study-ineligible physicians (not members of the ACSM) at our institution. Consent was indicated by survey completion.

## Data Analysis

Data were analyzed using SPSS version 21 (SPSS Inc). Descriptive statistics were calculated. Categorical variables were compared using the Pearson chi-square test or the Fisher exact test. Predictor variables were modeled using binary logistic regression. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. Significance was set at 5%.

## RESULTS

Among the 2191 physicians eligible for survey, 85 emails returned as “undeliverable.” Of the 2106 remaining participants, 572 (27.2%) responded to the survey (Table 1). Survey questions and results are shown in Figure 1 and Tables 2 through 7.

### Logistic Regression

Several physician characteristics were predictive of a perceived SIS risk at 2 weeks and 3 months postconcussion (Table 4). Respondents from the United States were more likely than respondents from other countries to list SIS as a risk at 2 weeks; sports medicine physicians were less likely to list SIS as a risk at 2 weeks and at 3 months; and physicians with greater than 10 years of experience were also less likely to consider SIS to be a risk at 2 weeks and at 3 months.

## DISCUSSION

Current guidelines endorse physical and cognitive rest as the cornerstone of acute concussion treatment, but evidence-based guidelines do not exist when postconcussion symptoms persist beyond the typical 7- to 10-day period. More than 90% of the physicians in our survey report adherence to the guideline recommendations of rest within the first week of injury, an improvement compared with a 2012 survey of family practice physicians where 75.5% recommended physical rest but only 28.4% recommended cognitive rest during the acute recovery period.<sup>12</sup> In contrast, there was less uniformity among our survey respondents regarding management practices and perceived health risks when concussion symptoms persist beyond the typical recovery period.

After an acute concussion, the symptomatic patient may have a lower concussion threshold, slower reaction times, and impaired balance, all of which could increase the risk of further injury if activities are advanced too quickly.<sup>7,9</sup> In our survey, physicians acknowledged several potential health risks related to the premature advance of activity. The most commonly identified risks included worsening of the current concussion symptoms and delayed concussion recovery. Few experimental data exist about the direct effects of physical and cognitive activity on acute concussion recovery. Complete physical and cognitive rest may not be practical (or beneficial).<sup>19,20</sup> Among 335 patients aged 8 to 23 years, Brown et al<sup>2</sup> found that those patients with the highest self-reported levels of cognitive activity after concussion had the longest recovery times. There were no differences among patients with complete cognitive rest and those with mild or moderate cognitive activity.

In our survey, physicians' perceptions of health risks differed at 2 weeks compared with 3 months after concussion. These health risks included worsening of current symptoms, delayed concussion recovery, lowered threshold for repeat concussion, and catastrophic risks such as SIS. Both the 2-week and 3-month durations represent degrees of abnormal postconcussion symptom persistence, yet fewer physicians acknowledged health risks when symptoms lasted longer. For

Table 1. Respondent demographics

	n (%)
<b>Country</b>	
USA	500 (87.4)
Other	72 (12.6)
<b>Medical specialty<sup>a</sup></b>	
Sports medicine	443 (77.4)
Family practice	239 (41.8)
Physical medicine	61 (10.7)
Pediatrics	59 (10.3)
Internal medicine	44 (7.7)
Orthopaedics	37 (6.5)
Emergency medicine	21 (3.7)
Neurology	4 (0.7)
Neurosurgery	2 (0.3)
Other	42 (7.3)
<b>Years in practice</b>	
<10	178 (31.1)
10-20	150 (26.2)
>20	228 (39.9)
Other (in training or not practicing)	16 (2.8)
<b>Practice setting<sup>a</sup></b>	
Solo	70 (12.2)
Group	200 (35)
Hospital-based	136 (23.8)
Government	18 (3.2)
Academic, clinical	206 (36)
Academic, research only	9 (1.6)
Other	32 (5.6)
Do not practice	12 (2.1)
<b>Percentage of concussion patients in practice<sup>b</sup></b>	
10	312 (56.8)
10-50	182 (33.2)
>50	22 (4.0)
Other (retired or do not practice)	33 (6.0)
<b>Percentage of concussion patients that are pediatric (&lt;18 years old)<sup>b</sup></b>	
<50	184 (35.6)
>50	306 (59.2)
Do not manage pediatric concussion	27 (5.2)

<sup>a</sup>More than 1 answer could be selected.

<sup>b</sup>Automatically skipped by some respondents based on prior answers.

Table 2. In the patient with postconcussion symptoms, do you typically recommend physical rest and cognitive rest (also referred to as “brain rest”) within the first week after injury?

	n (%) <sup>a</sup>
Yes, I typically recommend both	497 (92.9)
No, I rarely recommend either	9 (1.7)
I typically recommend physical rest but rarely recommend cognitive rest	24 (4.5)
I typically recommend cognitive rest but rarely recommend physical rest	5 (0.9)

<sup>a</sup>Excludes respondents who do not see patients within 1 week of injury (n = 10) and those who do not provide these sorts of treatment recommendations (n = 27).

Table 3. Two weeks/3 months after injury, what are the health risks associated with the gradual advancement of physical and cognitive activities in the patient who continues to experience postconcussion symptoms?

	2 Weeks After Injury, n (%) <sup>a</sup>	3 Months After Injury, n (%) <sup>a</sup>	P Value <sup>b</sup>
Lowered threshold for repeat concussion	349 (61)	263 (46)	<b>&lt;0.001</b>
Worsening of current symptoms	459 (80.2)	320 (55.9)	<b>&lt;0.001</b>
Delayed recovery from current concussion	443 (77.4)	273 (47.7)	<b>&lt;0.001</b>
Second impact syndrome	268 (46.9)	138 (24.1)	<b>&lt;0.001</b>
There are no potential health risks related to activity and postconcussion symptoms	17 (3)	84 (14.7)	<b>&lt;0.001</b>

<sup>a</sup>Excludes respondents who reported that they did not know (n = 22 at 2 weeks, n = 55 at 3 months) and those who marked “other” (n = 32 at 2 weeks, n = 48 at 3 months).

<sup>b</sup>Boldfaced P values indicate statistical significance.

Table 4. Predictors of second impact syndrome as a perceived health risk at 2 weeks versus 3 months

	2 Weeks			3 Months		
	OR	95% CI	P Value <sup>a</sup>	OR	95% CI	P Value <sup>a</sup>
Constant	1.78		0.02	1.5		0.34
US vs non-US	1.9	1.02-3.55	<b>0.04</b>	0.68	0.35-1.3	0.24
Sports medicine vs other	0.43	0.28-0.65	<b>&lt;0.001</b>	0.37	0.23-0.58	<b>&lt;0.001</b>
Academic vs other	0.97	0.66-1.4	0.86	1.19	0.76-1.85	0.45
>10% concussion patients vs <10%	0.75	0.52-1.09	0.14	0.81	0.52-1.26	0.35
>50% pediatric concussion vs <50%	0.95	0.65-1.4	0.8	0.7	0.45-1.1	0.12
>10 years' experience vs <10 years	0.66	0.44-0.97	<b>0.04</b>	0.57	0.36-0.9	<b>0.02</b>

OR, odds ratio.

<sup>a</sup>Boldfaced P values indicate statistical significance.

**Table 5. Is the persistence of postconcussion symptoms beyond 1 month an indication for brain scan (CT or MRI)?**

	n (%)
Yes	354 (61.9)
No	162 (28.3)
I do not know	30 (5.2)
I do not have an opinion	25 (4.4)

CT, computed tomography; MRI, magnetic resonance imaging.

example, more respondents considered SIS to be a potential health risk at 2 weeks than at 3 months, suggesting that the physicians perceive that the risk decreases over time, even as symptoms persist. In a subsequent survey question (intentionally worded differently), the majority responded that the SIS risk remains until all symptoms resolve, regardless of symptom duration. We cannot readily explain the apparent dissonance between responses. Perhaps the former question led fewer physicians to identify health risks at 3 months because they perceived a lower relative risk compared with 2 weeks, while the latter question lacked the 2-week comparison, causing more physicians to align their responses with the published consensus recommendations.<sup>1,5,8,9</sup>

Considering that the risk of catastrophic injury such as SIS plays an important role in concussion management, little is known about this risk when concussion symptoms persist. In a critical review of published SIS cases, the 5 patients with the most convincing evidence of SIS each sustained their second impact within 1 week of the first injury.<sup>16</sup> In our survey, certain physician characteristics predicted SIS as a perceived health risk at 2 weeks and at 3 months after concussion. Respondents from the United States may have been more likely to list SIS as a risk because of the predominance of SIS cases published from the United States and the absence of SIS cases reported in the European or Australian literature.<sup>14</sup> Sports medicine physicians and physicians with more than 10 years of experience were less likely to regard SIS as a potential health risk, which could reflect the ongoing debate about the mere existence of SIS in the sports medicine literature.<sup>3,14,16,17</sup>

In the acute concussion setting, neuroimaging is not recommended except in certain situations to rule out more severe brain injury, but no recommendations exist about neuroimaging when postconcussion symptoms persist.<sup>1,5,8,9,15</sup> The majority of physicians in our survey responded that neuroimaging is indicated when symptoms persist beyond 1 month. The utility of conventional neuroimaging for persistent symptoms is unclear; however, advanced neuroimaging techniques used in concussion research have shown some inconsistent abnormalities in patients with prolonged postconcussion symptoms.<sup>4</sup> To aid in the management of

**Table 6. When you refer patients with complex or persistent postconcussion symptoms to other medical specialists, to which medical specialist(s) do you refer?**

	n (%)
Neurology	332 (58)
Neuropsychology	294 (51.4)
Vestibular rehabilitation	208 (36.4)
Multidisciplinary concussion clinic	186 (32.5)
Headache specialist	96 (16.8)
Psychology	78 (13.6)
Sports medicine	56 (9.8)
Psychiatry	48 (8.2)
Neurosurgery	43 (7.5)
Other	36 (6.3)
I do not refer	28 (4.9)

**Table 7. Do you have a multidisciplinary concussion clinic within 60 miles of your medical practice?**

	n (%)
Yes	341 (59.6)
No	158 (27.6)
I do not know	67 (11.7)
I do not have a medical practice	5 (0.9)

complex or persistent postconcussion symptoms, referral to medical specialists and dedicated concussion clinics can be beneficial. We found a high referral rate to neurology and a small percentage of physicians who do not refer patients with complex or persistent postconcussion symptoms. These findings are consistent with a survey of general pediatricians where 95% acknowledged referring patients with persistent postconcussion symptoms to other medical specialists, with neurology being the specialty of choice.<sup>10</sup> Approximately one-third of the physicians in our survey refer to a multidisciplinary concussion clinic, whereas almost twice as many respondents have such a clinic within 60 miles of their practice.

We acknowledge several potential study limitations. Our response rate was relatively low, which can bias results. We limited our survey questions to 2 specific time points: 2 weeks

and 3 months. These time points were arbitrarily chosen to represent early persistent and late persistent symptoms. ACSM physicians with an interest in concussion may be more likely to respond to a concussion survey and may have different opinions and practices than nonresponders, limiting our ability to generalize results. Survey questions were multiple choice and provided few opportunities for respondents to write in comments or to qualify responses, which could limit accurate assessment of opinion. Finally, survey self-report may not reflect actual clinical practice.

## CONCLUSION

Whereas physical and cognitive rest are generally accepted in the management of acute concussion, physicians' perceived health risks and management practices vary when concussion symptoms persist.

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