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# Head Trauma and Concussions in Film and Television Stunt Performers

## *An Exploratory Study*

*Ariana B. Senn, MS, ATC, Leslie P. McMichael, PhD, Lori J. Stewart, BPE, and Jeffrey A. Russell, PhD, ATC*

**Objectives:** The aims of the study were to assess prevalence and management of head impacts in stunt performers and to evaluate performers' quality of life and ability to work after head injury. **Methods:** Stunt performers completed an online survey about head impacts/head whips history, diagnosed concussions, reasons for not reporting injuries, health care sought after head impacts, attitudes toward on-set concussion management, perceived ability to work as a stunt performer, and health-related quality of life. **Results:** One hundred seventy-three performers (80%) indicated at least one head impact/head whip during their stunt career. Of these, 86% exhibited concussion-like symptoms and 38% received one or more concussion diagnoses. Sixty-five percent continued working with concussion-like symptoms. Short Form-12 mental component scores were suggestive of depression in 42%. **Conclusions:** Concussion seems to be a serious occupational health issue in stunt performers. We suggest that concussion management, risk reduction, and education should be addressed in this community.

**Keywords:** concussion, mild traumatic brain injury, performing arts, film, television, stunts

Concussions are mild traumatic brain injuries (mTBIs) resulting in a variety of symptoms, such as altered consciousness, headache, dizziness, light sensitivity, decreased cognitive performance, slower reaction time, and impaired immediate recall.<sup>1-3</sup> Although imaging modalities do not reveal structural abnormalities in the brain after concussion, the symptoms are real and, in 10% to 15% of cases,

From the Neuro Tour Physical Therapy, Inc, Marietta, Georgia (Ms Senn); White Wing Enterprises, Ltd, Cochrane, Alberta, Canada (Dr McMichael); Union of British Columbia Performers/ACTRA, Vancouver, British Columbia, Canada (Ms Stewart); and Division of Athletic Training, Laboratory for Science and Health in Artistic Performance, School of Applied Health Sciences and Wellness, Ohio University, Athens, Ohio (Ms Senn, Dr Russell).

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Conflicts of Interest: L.P.M. and L.J.S. are members of the Canadian stunt community. L.P.M. is the owner and principal of White Wing Enterprises, Ltd, a company involved in stunt performance and stunt coordination. L.P.M.'s husband, Steven McMichael, is a stuntman and stunt coordinator. L.J.S. is independently contracted as a health and safety performer advocate by the Union of British Columbia Performers/Alliance of Canadian Cinema, Television and Radio Artists. J.A.R.'s institution, Ohio University, provided a grant to cover the open access publishing fee for this article.

At the time of data collection and analysis, Ariana Senn was a graduate student in Athletic Training at Ohio University. She is now a resident touring athletic trainer for Neuro Tour, Inc, Marietta, Georgia.

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Address correspondence to: Jeffrey A. Russell, PhD, ATC, Ohio University, School of AHSW, Grover Center E182, Athens, OH 45701 ([jeff.russell@ohio.edu](mailto:jeff.russell@ohio.edu)).

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### LEARNING OUTCOMES

After completing this article, the reader will be able to:

- Explain how recognizing concussion as an occupational injury in stunt performers can assist concussion reporting and management.
- Critically analyze the 5 primary reasons why stunt performers may be hesitant to report their head impacts, whiplashes, and head injuries.
- Summarize 6 ways that concussion may affect stunt performers' work performance due to documented concussion sequelae.
- Outline opportunities for promising future research that will expand knowledge of stunt performers' head injuries.

may persist for months or even years.<sup>3-5</sup> Concussions in athletic populations have received prime attention in sports medicine research for several years. Despite an increase in policies regulating the diagnosis and management of concussions in athletes, little consideration has been given to high-risk artistic populations.<sup>6-8</sup> Based on the nature of their work, film and television stunt performers presumably have one of the highest risks for head injury—and, therefore, concussion—among performing artists.

Stunt performers are a unique population of industrial athletes who perform a variety of physical activities, including motor vehicle crashes; interactions with explosions; horse falls; fights; flips; high falls; and impacts with structures, the ground, objects, and other performers. Stunts may also involve harness and wirework with high accelerations and decelerations created by mechanical and pneumatic devices designed to pull performers rapidly from one point to another. Their roles in film and television typically involve completing these hazardous maneuvers as stunt doubles in the place of actors. This ensures the safety of the cast, while also providing realistic execution of the required action. Stunt performers routinely work under intense film studio and TV network pressure in high-stakes environments that may negatively influence injury reporting and management.<sup>9</sup> Symptoms are easily concealed,<sup>2</sup> which further decreases the likelihood of stunt performers reporting a head injury. In addition, even if reported, head impacts accompanied by concussion-like symptoms may not receive proper evaluation for mTBI by a healthcare provider.<sup>10</sup>

Comparatively, in dancers—another artistic population at risk for concussions—13.9% with a diagnosed concussion and 38.3% who felt concussion symptoms after a "head hit" did not report their injury or symptoms to a healthcare professional.<sup>7</sup> The researchers found that dancers often did not think their injury was serious enough to warrant reporting symptoms.

Russell and Daniell<sup>6</sup> found high rates of head impacts and concussions among theater personnel, primarily those who work in technical positions. However, the participants demonstrated poor rates of injury reporting and low numbers of concussion diagnoses relative to the number of head impacts with concussion-like symptoms they

sustained. Reasons for not reporting may be financial concerns, lack of job security, and difficulty differentiating between pain associated with a job and pain caused by a serious injury.<sup>9</sup>

Furthermore, the culture seen in dancers and theater personnel of minimizing the severity of an injury and being reticent to report injuries also is present in traditional athletic populations. A study investigating concussion knowledge and reporting rates in mixed martial arts, boxing, and martial arts fighters found that 21% of respondents endorsed hiding concussion symptoms from their coaches and medical providers to continue fighting; these athletes cited an intrinsic love of fighting and a desire to win as reasons for not reporting.<sup>11</sup> Studies of collegiate athletes' reporting trends also demonstrated a lack of intent to report symptoms, even when concussion knowledge was high.<sup>12–14</sup> Therefore, it is evident that underreporting is a recurring issue when it comes to managing and treating concussions in artistic and athletic populations.

Challenges surrounding management of concussions sustained by stunt performers are related at least in part to a lack of empirical data documenting the prevalence of head injury in this population. A recent literature search elicited no published research about head injury prevalence or management in stunt performers.<sup>9</sup> An anecdotal case study<sup>15</sup> of a series of concussions sustained by actor James Cagney—including one where Cagney performed a stunt himself in lieu of a stunt performer—is 1 of only 2 known scientific articles before Russell et al<sup>9</sup> who mention concussions in film and television personnel. The other article identified work injuries occurring in the California motion picture industry<sup>16</sup>; concussions were responsible for only 0.63% of worker compensation claims across 7 years.

Stunt performers' reporting rates and what factors influence their decisions about reporting concussions are unknown apart from insights offered by Quirke<sup>17</sup> in a 2012 trade whitepaper. Based on worker's compensation claims in British Columbia, he suggested that head injuries that occurred in stunt performers were severely underreported and that the usual reason for this was performers' lack of understanding about the severity of the injury.

In light of the lack of peer-reviewed literature on the topic, the purposes of this study were to assess the prevalence and management of head impacts in Canadian stunt performers and to evaluate the performers' quality of life and ability to perform their job relative to their history of head injury. Ultimately, we desire to provide occupational advocacy for stunt performers that increases the likelihood they will report injuries and have access to specialized health care for those injuries. Canadians were selected because a substantial amount of film and television content is produced in Canada and the union representing stunt performers there was amenable to research about the health and well-being of their members. Based on the type of work they do, we hypothesized that 100% of stunt performers would report a history of head impacts or concussions and that most respondents would choose to not report their concussion symptoms due to shame, fear of losing work, or wanting to "tough it out."

## MATERIALS AND METHODS

### Participants

Participants were at least age 18 years, currently or previously employed as a stunt performer in film or television, and currently or previously a stunt performer member of the Alliance of Canadian Cinema, Television and Radio Artists (ACTRA) union. Survey invitations were distributed via email with the assistance of ACTRA. Participants clicked on a link in the email to access the survey. After reading about the study, its risks, and its benefits, all participants gave their informed consent by selecting "Yes" or "No" in the first item of the survey. A "Yes" answer allowed them to continue the survey, while a "No" answer ended the survey. The project received ethical approval from our university's institutional review board.

### Procedures

We administered the anonymous survey for this study via Qualtrics XM (Qualtrics International, Inc, Seattle, Wash). The survey was available for completion for 3 months from the time of the initial invitation e-mail. Follow-up invitations were sent every 6 weeks. Face validity was established by 2 of the authors (L.P.M. and L.J.S.) in their roles as community-engaged coinvestigators<sup>18</sup> working in the stunt industry. A copy of the survey is available by contacting the corresponding author. Figure 1 illustrates the processing of participants.

### Demographic Questionnaire

Providing informed consent directed participants to the demographic questionnaire. Collected demographic information included age, sex, active or retired status as a stunt performer, years of experience working as a stunt performer, and the Canadian province in which most of the participant's stunt work occurred. Participants also were asked to report how many head impacts/head whips they experienced outside stunt performing, how many head impacts/head whips they experienced as the result of a stunt, how many of the stunt-related head impacts/head whips resulted in concussion-like symptoms, and whether they had ever been diagnosed with a concussion by a medical professional. "Head whips" were included in the questionnaire's descriptor because a concussion can occur when the head is translated by a force applied to the body.<sup>1</sup> Rapid acceleration of the body then causes the "whipping" of the head. For convenience's sake, later we may refer to "head impact/head whip" as only "head impact."

If participants reported never having experienced a head impact or head whip as the result of a stunt, they were directed to the Short Form-12 (SF-12; QualityMetrics, Johnston, RI) health-related quality-of-life questionnaire and then to the Injury Reporting and Safety Attitudes Questionnaire. If they answered that they had experienced a stunt-related head impact/head whip, they were sent to the Concussion and Head Impact History Survey, and then to the SF-12 and the Injury Reporting and Safety Attitudes Questionnaire. Data collected on head impacts/head whips and diagnosed concussions informed the prevalence in our sample.

### Concussion and Head Impact History Survey

After completing the demographics questionnaire, participants were asked to detail their history and experience in managing head injuries and concussions. History included disclosing their number of stunt-related head impacts that resulted in concussion symptoms, number of diagnosed stunt-related concussions, symptom reporting history, reasons for not reporting their head injuries (if applicable), and medical care sought after each head injury.

### Health-Related Quality of Life

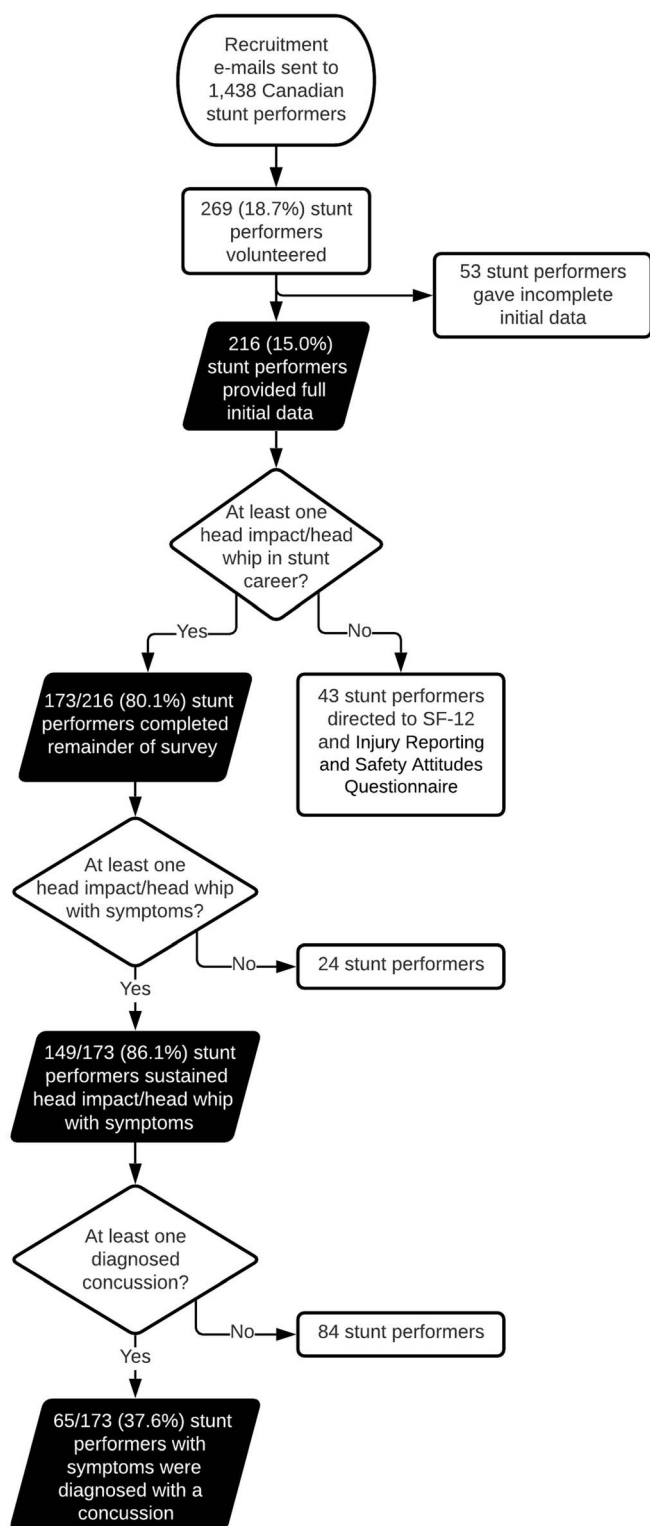
Next, the participants were directed to the SF-12 survey. This is a 12-question instrument that assesses health-related quality of life based on a respondent's perception of their physical, mental, and social health. SF-12 results were calculated as physical component scores (PCSs) and mental component scores (MCSs).

### Injury Reporting and Safety Attitudes Questionnaire

After completing the SF-12, all participants were directed to the Injury Reporting and Safety Attitudes questionnaire. This consisted of 7 questions inquiring about participants' opinions on concussion and head injury management on set.

### Data Analysis

We calculated frequencies for history of head injuries and concussions, reporting history, and ability to perform one's job as a stunt performer since the initial head injury. We performed  $\chi^2$  tests for sex and head impact history and sex and reporting history. We conducted a



**FIGURE 1.** This flowchart illustrates how participants were processed through the study, with numbers of participants indicated for key stages.

Spearman rank correlation between years active as a stunt performer and number of head impacts and a Pearson correlation between age and reporting history. We also calculated Pearson correlations among total number of lifetime head impacts, SF-12 PCS score, and SF-12

MCS score.  $\alpha$  was set at 0.05 for all inferential analyses. Calculations were performed with SPSS version 27 (IBM, Inc, Armonk, NY).

### RESULTS

E-mail invitations to participate in the online Qualtrics survey were sent to 1438 Canadian stunt performers. Of those, 269 (18.7%) began the online survey; however, 53 of them did not finish it, so their data were discarded. Thus, a sample comprising 216 of 1438 (15.0%) currently active or former Canadian film and/or TV stunt performers (141 males, 75 females, mean age =  $43.3 \pm 11.1$  years; range = 22–71 years) fully completed the survey. Of these, 189 (87.5%) were currently active in the industry. They had a mean of  $15.8 \pm 10.2$  years (range = 1–43 years) of experience as stunt performers. One reason for the low response rate was likely the substantial reticence of stunt performers to disclose their injury history. There are personal and occupational reasons for their reservations; notable among these is the possibility that their reputation, earning potential, and ability to continue performing stunts in the future could be adversely affected if the production staff or stunt coordinators learned of their injuries.

The prevalence of receiving a head impact/head whip during stunt-related work was 80.1%. Table 1 displays our full frequency data for head impacts and concussions, whereas Table 2 shows the number of symptom-eliciting head impacts the stunt performers identified. Approximately 40% of respondents had sustained 5 or more head impacts in their career. Spearman rank correlation revealed a weak positive correlation between years active and number of head impacts with symptoms [ $\rho(171) = 0.276, P < 0.001$ ]. That is, the number of head impacts that were associated with symptoms tended to be greater in those with more years of experience working as a stunt performer, although this relationship was not as strong as expected.

Table 3 expresses the reporting behaviors of our sample for head impacts/head whips with symptoms. Just more than half (54.9%) reported their injury to on-set personnel or directly to a physician. The reasons why the stunt performers did not report their head injuries are detailed in Table 4. The most common reason—accounting for 29.0% of the answers—was that the participants did not realize the seriousness of their injury at the time it occurred. Half of those with a stunt-related head impact history indicated they experienced a change in their ability to perform their job as a stunt performer (Table 5).

Mean PCS score for our participants was  $54.6 \pm 7.0$  (range = 23.7–66.3); mean MCS score was  $47.0 \pm 9.9$  (range = 13.5–63.7) on a scale of 0 to 100 (Table 6). Higher scores in these correspond to better health. Ninety-one of our participants (42.1%) had MCS scores less than 45.0. Fifty-three (24.5%) had MCS scores less than 40.0, and 13 (6.0%) were less than 30.0. Two MCS scores were less than 14.0. We calculated weak negative correlations between the number of total lifetime head impacts and both PCS ( $r = 0.274, P < 0.001$ ) and MCS ( $r = 0.243, P < 0.001$ ). That is, both PCS and MCS tended to be worse in participants who indicated they had experienced more head impacts.

No significant relationship existed between age and head impact reporting history ( $r = 0.043, P = 0.574$ ).  $\chi^2$  testing suggested that there was no significant relationship between sex and head impact reporting history [ $\chi^2(2173) = 1.363, P = 0.506$ ]. Likewise, while a greater percentage of females experienced at least one stunt-related head impact relative to males, there was no significant relationship between sex and history of stunt-related head impacts [ $\chi^2(1216) = 0.477, P = 0.490$ ].

### DISCUSSION

The purposes of this study were to assess the prevalence and management of head impacts in Canadian stunt performers and to evaluate the performers' quality of life and ability to perform their job relative to their history of head injury. The results of this study suggest an 80% prevalence of at least one self-reported stunt-related head impact/head whip among stunt performers. Although this does not support our hypothesis that 100% of stunt performers have experienced a

**TABLE 1.** Head Impact and Concussion Frequencies in Stunt Performers

	No. Participants Sustaining Head Impact/Head Whip	Males		Females		Number Sustaining a Head Impact/Head Whip With Symptoms	Number Sustaining a Diagnosed Concussion
Did receive a head impact/head whip	173/216 (80.1%)	111/216 (51.4%)	62/216 (28.7%)	149/173 (86.1%)	65/173 (37.6%)		
Did not receive a head impact/head whip	43/216 (19.9%)	30/216 (13.9%)	13/216 (6.0%)	24/173 (13.9%)	108/173 (62.4%)		
Total	216	141	75	173	173		

stunt-related head impact/head whip, the risk of concussion among TV and film stunt performers nonetheless seems to be high. The prevalence we observed is greater than that reported for dancers, theater personnel, and professional fighters.<sup>6,7,11</sup> Considering the inherently dangerous nature of stunt work, it is remarkable for a stunt performer to not sustain at least one head impact or head whip.

Our 80% career prevalence of 1 or more stunt-related head impacts or head whips stands in stark contrast to the results of a whitepaper by Quirke<sup>17</sup> that reported only a 44% career prevalence of one or more “concussion or head injury” episodes in stunt performers based on the performers’ self-reported histories. We are not certain what might account for this disparity. Participants may have had a perception difference between the descriptors “concussion or head injury” in the prior study and “head impact or head whip” we used. Based on current consensus of concussion mechanisms,<sup>1</sup> we believe that “head impact or head whip” offers stunt performers a valid identification of potential occurrences that could lead to a concussion.

The extent to which our respondents may have shown a greater inclination to be truthful in recording their head injury history than those summarized in the Quirke study is unknown. Overall, we believe that it is unlikely that stunts became sufficiently more dangerous between 2012 and 2021 as an explanation for our prevalence being nearly double that previously reported. It is possible that cultural changes in the industry (leading to greater acceptability of injury reporting) since 2012 could account for some improvement in willingness to acknowledge head injuries when completing an anonymous survey. It also may be that older, more experienced stunt performers tend to report head injuries more frequently because their age gives them a perspective focused on preservation and longevity compared with younger performers.

Being more established in their field—and, therefore, less likely to lose work because of an injury—may make experienced performers less hesitant to report their injuries, as well. Our participants’ mean age was 43 years with a mean experience in stunts of 16 years. Unfortunately, the nature of Quirke’s results did not allow us to directly compare our participants’ ages or years of experience to those of his participants.

We hypothesized that a majority of the respondents would choose not to report their concussion symptoms due to shame, fear of losing work, or wanting to “tough it out.” Those 3 reasons accounted for 44.5% of the responses; though substantial, our hypothesis was incorrect. The most common reason selected was “I did not realize the severity of the injury at the time,” suggesting that an educational

system about head injuries may be needed in the stunt industry, including education about how reporting should be done in a given situation or venue as prescribed by Warmath and Winterstein.<sup>12</sup>

As expected, the number of stunt performer respondents reporting diagnosed stunt-related concussions was considerably fewer than the number who indicated they sustained a stunt-related head impact in general. Of those who told us they had experienced at least one head impact, 86.1% experienced concussion-like symptoms, while only 37.6% of them received a concussion diagnosis. This difference in reporting between “concussions” and “head impacts with symptoms” depending on how an incident is designated also was noted in dancers,<sup>7</sup> although the difference between the percentages in our study was greater than that for the dancers. Furthermore, this discrepancy seen in stunt performers suggests that concussions are underdiagnosed in this population; a performer must report a head injury to a healthcare professional if there is to be an opportunity for a diagnosis.

Forty-five percent of our respondents with a stunt-related head impact history identified at least one instance when they experienced a stunt-related head impact with symptoms, but they did not report the incident to a stunt coordinator or medical professional on set. As noted previously, the most common reason they gave was not realizing the severity of the injury at the time; 60% of them selected this answer. The study by Quirke<sup>17</sup>—in some ways comparable in approach with ours—also indicated this to be the most common reason for nonreporting. In addition, and similar to our findings, 67% of dancers surveyed did not think that their head injury was serious enough to report.<sup>7</sup> Whether our results correspond to a lack of understanding about the medical diagnosis of concussion, differing behaviors depending on the label attached to a head impact, a reticence to obtain qualified healthcare, or an inadequate ability of healthcare providers sought for care to diagnose a concussion requires further study.

There is a caution if the response to these results is a push for stunt performers’ education about concussions and head impacts. Available evidence lacks clarity about the extent to which concussion education improves the likelihood that an individual who sustains a head injury will report it or seek healthcare. Some suggest that simply educating individuals about concussions does not significantly influence reporting rates among various populations.<sup>12–14</sup>

Other research indicates that education improves attitudes about concussion, even without improving reporting tendency. A study of motorsports (an activity similar to some types of stunt work) in which participants had not been formally educated about concussion before a concussion workshop given as part of the investigation showed that knowledge about concussion increased after the workshop, as did

**TABLE 2.** Number of Head Impacts With Symptoms Sustained by Stunt Performers

No. Head Impacts With Symptoms	Number Reporting
1	25 (16.8%)
2	27 (18.1%)
3	24 (16.1%)
4	14 (9.5%)
5–10	36 (24.1%)
11–19	2 (1.3%)
>20	21 (14.1%)
Total	149 (100%)

**TABLE 3.** Reporting Frequencies of Stunt Performers’ Head Impacts/Head Whips

	No. Head Impact/Head Whip With Symptoms
Reported on set	80 (46.2%)
Not reported on set	78 (45.1%)
Reported directly to physician instead	15 (8.7%)
Total	173

**TABLE 4.** Reasons for Stunt Performers Not Reporting Head Impacts/Head Whips

Reason for Not Reporting	No. Times Answer Given (Numerator)	Percentage of the Answer Out of Total Answers Given <sup>a</sup>	Percentage of Head-Injured Stunt Performers Giving the Answer <sup>b</sup>
I did not realize the severity of the injury at the time	104	29.0%	60.0%
I did not want to appear weak or I felt I needed to “tough it out”	69	19.3%	39.9%
I feared I would lose work if I reported it	65	18.2%	37.6%
I did not want to let crew or production down	53	14.8%	30.6%
I was embarrassed or ashamed	25	7.0%	14.5%
Other	42	11.7%	24.3%
Total	358	100.0%	— <sup>c</sup>

<sup>a</sup>Denominator = 358 total answers given by the 173 participants.

<sup>b</sup>Denominator = 173 head-injured participants responding.

<sup>c</sup>Total is greater than 100% because participants were allowed to select more than one answer.

participants’ attitudes about how they would act if they sustained a concussion.<sup>22</sup> Notably, however, these researchers did not address the effect of these improvements on the likelihood that patients with a concussion would report their head impacts.

Register-Mihalik et al,<sup>23</sup> in their study of concussion education in National Collegiate Athletic Association (NCAA) collegiate student-athletes, could not identify significant associations between the quantity of educational programming and concussion knowledge, attitudes, care seeking, or reporting. They did, however, suggest the importance of effective concussion education as they noted differences in how the quality and type of such offerings may affect concussion outcomes. In addition, they indicated that concussion education may make an individual’s head injury care seeking more socially acceptable. How, or if, this translates to the stunt industry we studied is currently unknown.

Overall, an understanding of what reporting steps should be taken when a head impact occurs has been associated with better intentions to report symptoms.<sup>12</sup> Furthermore, familiarity with specific concussion symptoms may also positively influence reporting intention. Unfortunately, there are no required reporting guidelines nor is there a uniform concussion protocol across film studios, directors, producers, stunt coordinators, and on-set medical providers. Moreover, stunt performers rarely undergo formal training on head safety standards or expectations.

Sixty-five percent of our respondents with a stunt-related head impact history indicated that they did not report their injury on set and continued to work with concussion-like symptoms. After a traumatic brain injury, a series of metabolic changes occur in the brain that can have functional consequences, such as decreased cognition and motor function.<sup>24</sup> Given the highly skilled, physical nature of stunt performance, continuing to work with symptoms such as dizziness, blurred vision, confusion, and difficulty concentrating may put a stunt performer at great risk of further injury, including vulnerability to substantial neurological damage should a second head impact occur.<sup>13,24</sup> It is important to note that presenting with concussion-like symptoms after a head impact is not always indicative of a concussion. However, to avoid instances of a second concussive impact,<sup>1,13,14,25</sup> a concussion should be ruled out by a qualified healthcare professional before an individual who sustains a head impact returns to activity. Overall, the rates of underreporting that seem to exist among stunt performers combined with the large percentage of stunt performers who may opt to continue working with symptoms after a head impact are alarming.

Reasons for not reporting symptoms may be influenced by environmental and cultural factors. There is a certain level of “toughness” one may be expected to embrace when performing at an elite level of sport or artistry, and the ability to fight through pain and injury is a cultural staple of sports and highly skilled artistic fields alike.<sup>7,14</sup> Forty percent of our respondents with a stunt-related head impact history indicated, “I did not want to appear weak or I felt I needed to ‘tough it out,’” and 38% feared losing work if they reported their head impact.

These reasons for nonreporting among stunt performers are in line with what has been found in athletic populations. A study of university athletes found that the top reasons for hiding concussion symptoms included thinking they can just “tough it out,” being afraid they will lose future playing time, not wanting to let down their teammates and coaches, and not thinking an injury is serious enough.<sup>14</sup> It is clear from these responses that both intrinsic motivation and external pressures play roles in one’s decision to not report a possible concussion. Previous literature has proposed that external pressures from coaches and teammates may outweigh logic in high stress, emotionally driven situations.<sup>12–14</sup>

It seems that a realization of the importance of appropriate concussion care may come later in a stunt performer’s career. We base this observation on the answers our participants gave to the question about the extent to which they felt head injuries affected their ability to perform their work. The answers they offered—if indeed these can be linked to head injuries—raise concerns for stunt performers’ safety as they undertake future dangerous stunts. Association between both concussive and subconcussive injuries and decreasing cognitive function have been reported in sports.<sup>26–28</sup>

Seventy-two percent of our stunt performers with a head impact history experienced two or more head impacts with symptoms. Given the risk of long-term symptoms and changes in performance commonly seen in individuals experiencing multiple concussions,<sup>5,29–31</sup> one might expect stunt performers to note changes in their ability to perform their job. Interestingly, 53% indicated that they noticed no change in their ability to participate in work. Whether this higher-than-expected percentage is related to stunt performers’ reticence to report their injuries or a “tough it out” mentality is not known. In the survey by Quirke,<sup>17</sup> 35% of stunt performers reported that the physical nature of stunt work had a negative effect on their health and quality of life; although in his article, this was not specifically related to head injuries. Overall, we suggest that the ability changes perceived by many of our participants could elicit substantial negative effects on their work capacity over time.

**TABLE 5.** Work Performance Ability Changes as Reported by Stunt Performers

Perceived Changes in Ability to Perform	Number Reporting
No change in performance ability	92 (50.3%)
More difficulty remembering choreography	31 (16.9%)
More distracted on set	20 (10.9%)
Decreased reaction time	17 (9.3%)
More negative interactions with others on set	14 (7.7%)
More difficulty “hitting your mark” or more difficulty with accuracy	9 (4.9%)
Total	183 (100%)

**TABLE 6.** SF-12 Health-Related Quality of Life Scores for Stunt Performers (n = 216)

	PCS	MCS	
Mean	54.64	46.97	
SD	6.97	9.91	
Range	23.68–66.25	13.48–63.73	
No. participants with scores...	MCS < 51.5*	MCS < 45.0†	MCS < 40.0‡
Of those with at least one stunt-related head impact (n = 173)	108 (62.4%)	69 (39.9%)	43 (24.9%)
Of those with no stunt-related head impact (n = 43)	30 (69.8%)	22 (51.2%)	10 (23.3%)
Of all 216 stunt performers	138 (63.9%)	91 (42.1%)	53 (24.5%)

\*A score of 51.5 is normative for Canadians.<sup>19</sup>

†Less than 45.0 is suggestive of depression disorder in Canadians.<sup>20</sup>

‡Less than 40.0 is suggestive of depression or generalized anxiety disorder.<sup>21</sup>

A study of ex-Canadian Football League players found that memory impairments later in life were associated with brain structural changes in those with a history of concussions and that repeated concussions may lead to increased hippocampal atrophy.<sup>30</sup> Although our study only considered perceived changes after a head impact with symptoms, the potential for memory changes should not be overlooked. Carlson et al<sup>32</sup> found an increase in anxiety symptoms after a recent sports-related concussion in collegiate athletes. Similarly, high levels of anxiety and depression as long-term sequelae of concussions in ex-NFL players have been discovered.<sup>33</sup> These reports of decreased mental and physical health among individuals with a history of concussions align with our finding of a significant, although weak, negative correlation between number of lifetime head impacts and physical and mental health scores. Future prospective studies should investigate measured changes in cognition and emotional health after head impacts or concussions in stunt performers.

Finally, total SF-12 scores generally are lower than normal in individuals with health complaints,<sup>19</sup> but our SF-12 MCS results seem particularly troubling. An MCS of 51.5 is considered normative for Canadians<sup>19</sup>; we calculated a mean MCS of 46.97 for all participants. Scores less than 45.6 are suggestive of depression disorders with a sensitivity of 0.86 and specificity of 0.88 as measured in a European population,<sup>34</sup> while researchers who studied Canadians with low back pain implemented an MCS score of 45.0 as the cutoff for depression.<sup>20</sup> Researchers analyzing an Australian population established a cut point of 40 as suggestive of depressive disorders or generalized anxiety disorder.<sup>21</sup> While our MCS mean of 47 is only slightly less than “normal,” 69 of the 173 participants (39.9%) who told us they sustained one or more stunt-related head impact had MCS scores less than 45.0. In addition (and surprisingly), more than half of the 43 participants (22, 51.2%) who claimed to have not sustained a head impact in their career had MCS scores less than 45.0. Thus, 42.1% of our entire sample presented MCS scores suggestive of depression disorders. We are especially concerned about the one-quarter of our 216 participants (n = 53, 24.5%) who scored less than 40.0 for the MCS. Taken together, our findings suggest that mental health support for many stunt performers is urgently needed, and certainly, this area requires further research.

Our study has some limitations. As mentioned previously, our study was of a retrospective self-report nature and, thus, may be affected by recall bias because we asked respondents to recall and estimate injuries from the entire course of their career. In addition, with anecdotal reports that head impacts are expected in such a dangerous profession alongside concussions having a negative effect on cognitive ability, the ability of stunt performers to accurately recall their head impact history can reasonably be questioned. However, it seems that they would be more likely to forget head impacts than conjure up ones that did not occur; thus, our data may underestimate the true prevalence.

Also related to individual participation in this study by stunt performers, the number head impacts and head whips reported, and our overall results is the potential for survivor bias. In such a situation, stunt performers who were older, had more head impacts, head whips, or concussions, or had more negative health outcomes would be more likely to have left the field of stunt performance and, thus, would have been lost to our study.

It is possible that stunt performers in the population from which we recruited who had a history of concussions or head impacts were more likely to participate in the study, thus creating ascertainment bias. The recruitment emails we sent encouraged all ACTRA stunt performers to participate regardless of their head impact history, but obviously with the constraints previously mentioned, it was not possible to compel an ideal participation sample. If ascertainment bias was present, it may have been manifest in the differences between our results and those of Quirke.<sup>17</sup>

Future studies should consider the extent to which concussion knowledge is associated with symptom reporting or intention to report among stunt performers. Moreover, research to identify ways to improve not only reporting occurrence but also the reporting structure available to stunt performers is an important undertaking, as is studying long-term effects of concussions in stunt performers and methods of reducing the risk of concussions through new safety measures that can mitigate forces incurred to the head. Finally, most useful for determining true concussion prevalence and incidence would be a prospective study of head impacts in this population; however, the current culture in the stunt performer community regarding injuries is a substantial barrier to this type of research.

In conclusion, this exploratory descriptive study suggests that head impacts with concussion-like symptoms are highly prevalent among TV and film stunt performers. We also discovered a sizable percentage of our respondents who exhibited SF-12 MCSs that are suggestive of depression. The apparent risk of sustaining a concussive head impact highlights head injuries as an area that may deserve more attention throughout the stunt industry. Management strategies should not only address procedures to be followed once a head impact is sustained but also consider the role stunt coordinators and industry professionals play in encouraging (or discouraging) symptom reporting, as well as the need for the availability of mental health resources for stunt performers.

Film sets are unique workplaces, so specific reporting guidelines should be developed. This will ideally include information about who should receive reports and what actions should be taken—an approach that would be a counterforce to the “cowboy culture” of “toughing it out” in the industry that heightens stunt performers’ reticence to report their head impacts. Stunt coordinators may be a key to changing this culture because it is not practical for the risk of concussions to be eliminated from stunts. Thus, to encourage better reporting and appropriate long-term management of stunt-related head injuries, we recommend

improved social, emotional, financial, and healthcare support for stunt performers who inevitably will endure work time-loss due to a head injury.

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